PUBLIC WORKS

May
1956

CITY, COUNTY AND STATE

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in Water Supplies . . .
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pages 103-106

NAMING AND
NUMBERING
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LIST ON PAGE 5

Paul Weir, General Manager of the Atlanta, Ga., Water Department and President of the American Water Works Association. More data on page 26.

The Most Complete Line

8 Models GALION MOTOR GRADERS

Most "PUSH-POWER" at the Blade

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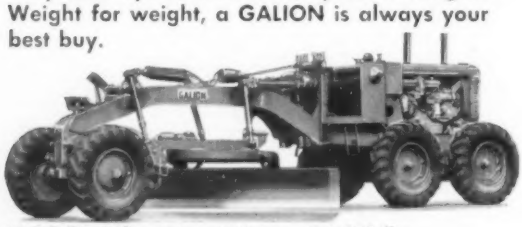
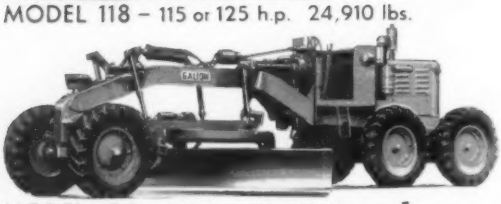
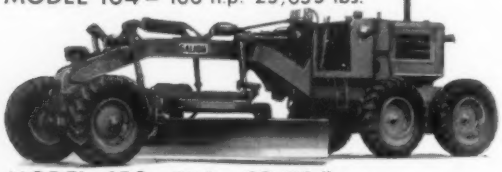


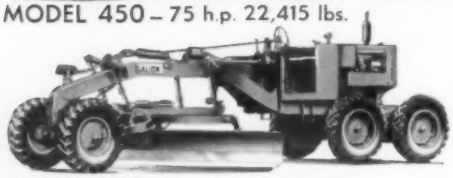
MODEL 118 – 115 or 125 h.p. 24,910 lbs.



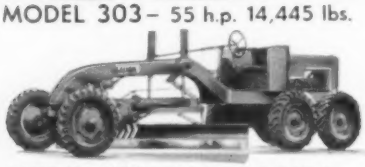
MODEL 104 – 100 h.p. 23,635 lbs.



MODEL 450 – 75 h.p. 22,415 lbs.

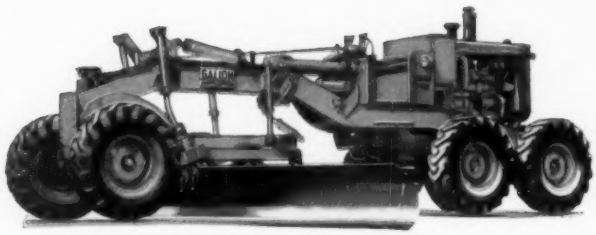


MODEL 303 – 55 h.p. 14,445 lbs.

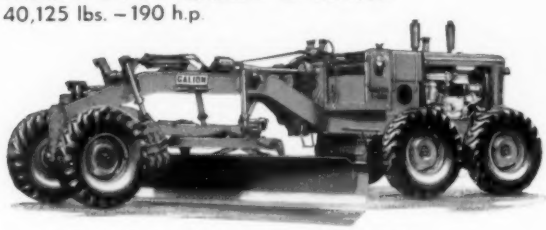


MODEL 503 – 50 h.p. 9,360 lbs.

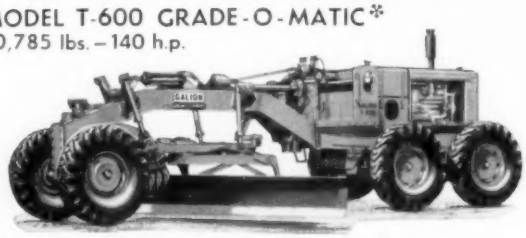
* Galion GRADE-O-MATIC Graders utilize a Torque Converter with tail shaft governor and Power-Shift Transmission



MODEL T-700 GRADE-O-MATIC *
40,125 lbs. – 190 h.p.



MODEL T-600 GRADE-O-MATIC *
30,785 lbs. – 140 h.p.



MODEL T-500 GRADE-O-MATIC *
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- ☐ Model T-600
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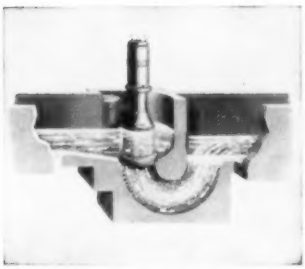

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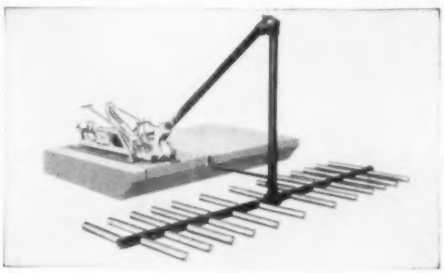

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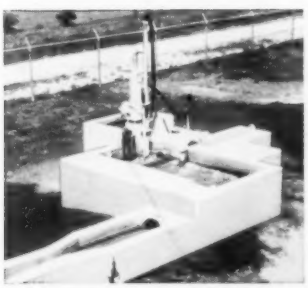
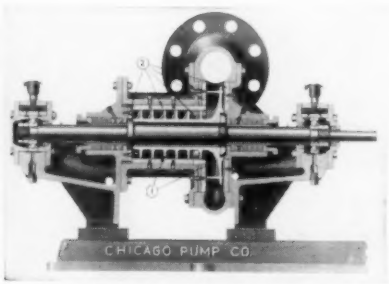


AER-DEGRITTER



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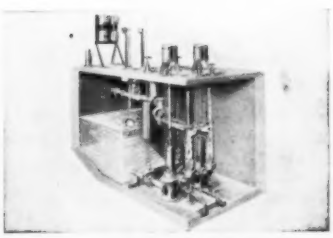

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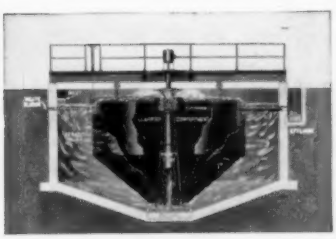

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NO. 933 TRAXCAVATOR*
on top of garbage disposal in Taylor, Texas

The City of Taylor, Texas, is another progressive community that gets rid of its garbage and trash by the sanitary landfill method. For some years a Caterpillar HT4 Traxcavator, purchased in 1946, was used. When the machine had run 20,000 hours it was traded in—at a good price—on a new CAT* No. 933 Traxcavator.

The Traxcavator does all the trenching, spreading, compacting and filling in layers, according to the recommended practice. "We haven't found its limit yet," says City Manager F. R. Cromwell. "It easily handles all garbage disposal for a city of 11,000."

The No. 933 is one of three new Traxcavators in the Caterpillar line, all efficient units for sanitary landfill as well as for other digging and loading purposes. Bucket capacities are 1 cu. yd. for the No. 933; 1½ cu. yd. for the No. 955; 2¼ cu. yd. for the No. 977. All have the traction and power to dig in hard material, to give you fast lifting action and easy maneuverability. A new oil-type clutch reduces maintenance and greatly lengthens clutch life. Full loads at every pass are assured by 40-degree tilt back of the bucket at ground level.

Nearly a thousand municipalities are now using Cat equipment to do a better job of sanitary garbage disposal. Your Caterpillar Dealer is equipped to help your engineers plan the most satisfactory method for your city. He has the right machines to fit your needs in a complete line of Traxcavators, bulldozers and scrapers, and the factory-trained service men to keep them in top condition. Ask him for a demonstration at the site you choose.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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PUBLIC WORKS MAGAZINE

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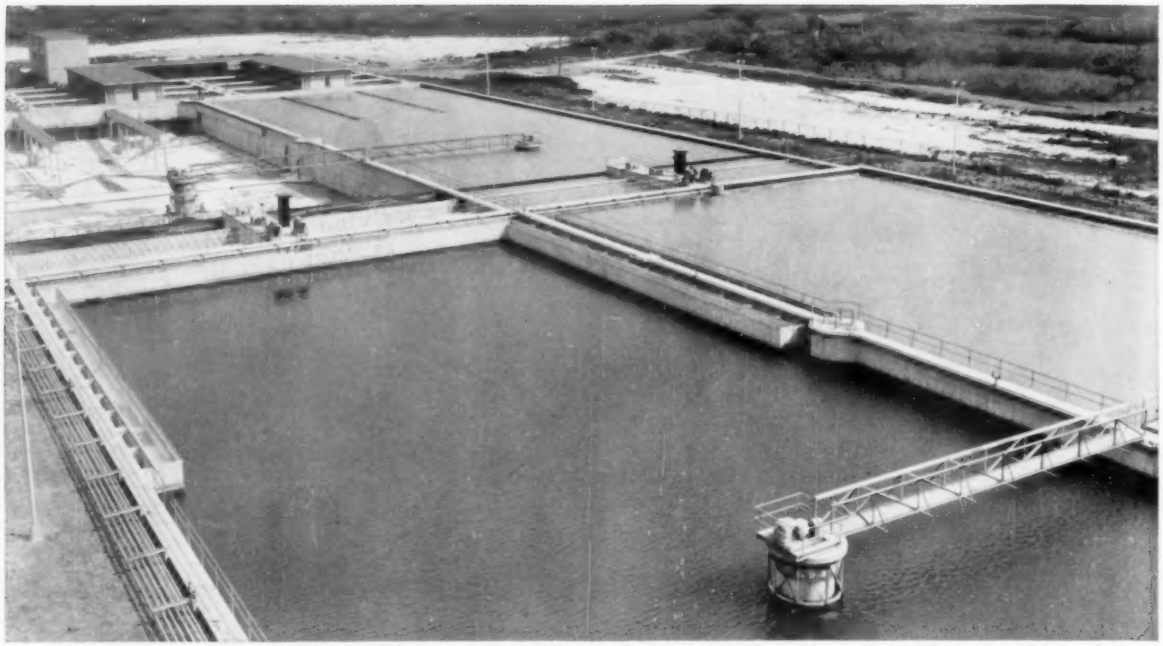
THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES



New 48-mgd filtration plant can handle 50% increase easily, 100% surge in emergencies. Consulting engineers: Reagan and McCaughan.

CORPUS CHRISTI, TEXAS

Produces pure, clear water from muddy Nueces River

with LINK-BELT collectors . . . mixers . . . chemical handling system

TYPE SC CIRCULINE SLUDGE COLLECTORS, with pivoted rakes at ends of arms, adjust to collect sludge in corners of basin.

STRAIGHTLINE SLOW MIXERS are used in primary and secondary chambers. Detention time: 45 minutes at 48 mgd capacity.

LINK-BELT SCREW CONVEYORS AND BUCKET ELEVATORS distribute lime, sulphate and alum to tanks for live or reserve storage.

WATER from the Nueces River supplying Corpus Christi is hard and muddy. To provide ample water for the rapidly expanding population—which has doubled each decade since 1920—treatment facilities featuring Link-Belt equipment were installed at the new O. N. Stevens water filtration plant. A two-stage treatment provides rapid and thorough solids removal . . . effectively reduces the river's 142 ppm hardness.

Link-Belt is supplying specific answers to specialized water, sewage and waste treatment problems for municipalities and industries throughout the country. A broad line of screens, collectors, mixers, conveyors and power transmission equipment offers durability that minimizes maintenance . . . helps you plan your requirements for the years ahead.

Let our engineers work with you, your chemists and consultants to assure top efficiency at all flow conditions. Call your nearest Link-Belt office for consultation with a sanitary engineering specialist.

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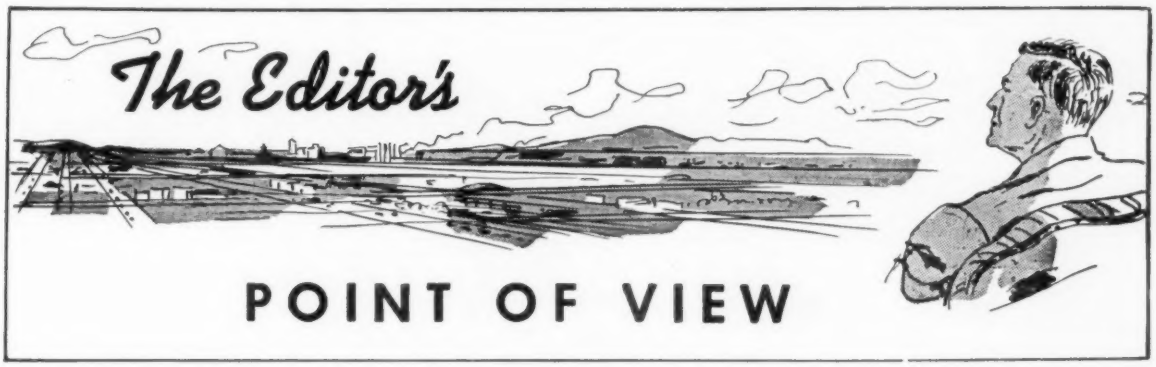


Congratulations to the American Water Works Association and to Harry Jordan

FOR THREE-QUARTERS of a century the American Water Works Association has carried on in the best traditions of engineering, providing a leadership for the water works industry in its job of serving the nation. Few engineers have failed to profit, at one time or another, from the knowledge so carefully garnered from all over the world and presented in a useful and usable form for the benefit of everyone.

Yet when we think of the AWWA and of its accomplishments, we think in the same instant of Harry Jordan and of what he has done personally to give that association the leadership, the energy and the purpose which have so inspired it. We engineers are fortunate to have such an association and doubly so to have it in the hands of Harry Jordan.

Research and Engineering Skills Can Meet our Future Water Needs

THERE ARE TWO kinds of water shortages. One is due to a basic lack of water and the other to inadequate distribution facilities. Engineering skill, money and time can remedy the latter; but the former represents one of those "impossibles" which it takes a little longer to overcome. However, progress is being made in some directions. Control of evaporation is now a subject of promising research. This could make a substantial contribution to our usable water. It has been estimated that Texas uses 8 billion acre feet of water for all purposes annually; and that 7 1/2 billion acre feet are lost each year through evaporation. If half of this loss could be prevented, it would be a big step toward meeting water needs for some time in the future.

The air around us contains a great deal of water. It has been estimated that a column of aqueous vapor extending through the atmosphere contains approximately 1.9 ins. of water; and that normal air would contain from 0.4 to 0.8 inch at a temperature of 70°F. If even a portion of this water in the atmosphere could be reclaimed, it would represent a substantial addition to present supplies in arid areas. Attempts have been made, of course, to get some of this water by seeding the clouds; but perhaps there are other methods that can be developed. Even though the unit cost might be high, it could be an excellent investment for those communities that have nearly, but not quite, enough water to meet those high peak loads on summer afternoons. A few cubic miles of air, fairly well filled with moisture, could be a great help to a harried water works superintendent—if he had the means of putting to use even a portion of moisture that they contain.

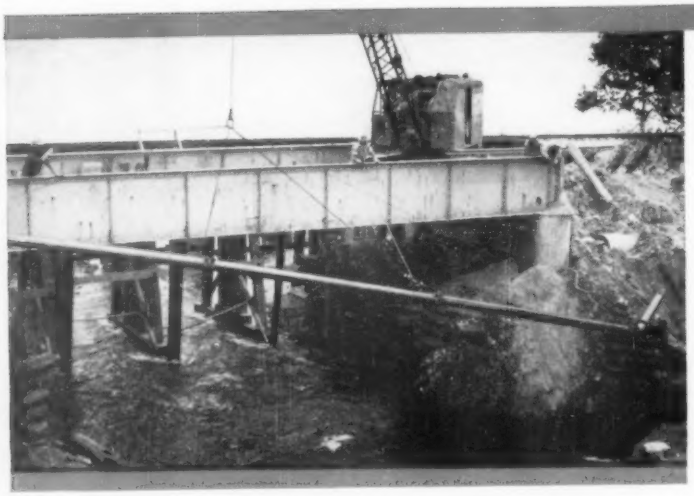
Streets and Highways Have Had a Hard Winter in the North

THE WINTER JUST passed has been a hard one on streets and highways in many northern states. There are more pavement breaks and potholes than in a good many years. The essential thing to do is to care for them promptly and properly. The time element depends on the efficiency of the local maintenance organization and, in large measure, on the modern equipment it is able to utilize for the work. The methods for properly doing the work are well established, as was described in an excellent article in this magazine a couple of years back. There are too few roads to take care of the traffic now using our highways and streets, and this is all the more reason to do all that personnel and equipment can do to have the winter breaks repaired promptly and properly.

Opportunities in Civil and Public Works Engineering

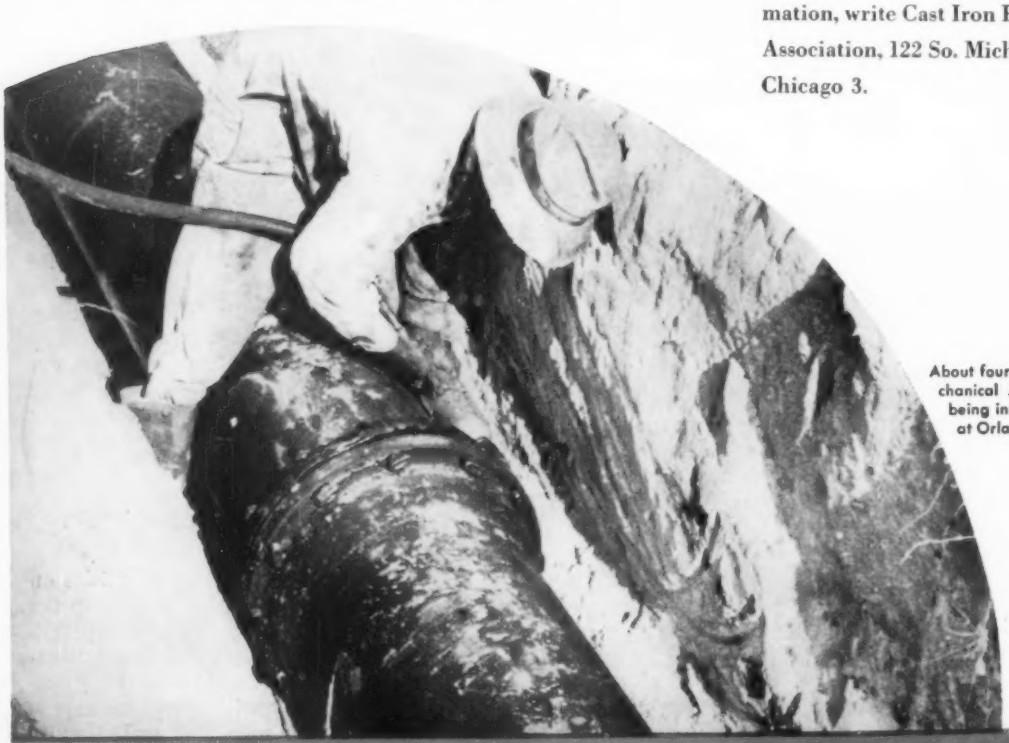
RESPONSES TO OUR first series of articles on the opportunities in civil and public works engineering have been unusual, perhaps extraordinary, in quality and quantity. They illustrate the deep feeling that engineers have for their profession and their willingness or eagerness to help the younger men who would enter this field. If this depth of feeling could be made evident to the high school group there would be no shortage of engineering students; but the ability to transmit to others that inward regard for their profession is unfortunately lacking in too many engineers. It is something engineers are not taught in college.

When you use it



Installing 6-inch Mechanical Joint cast iron pipe for pressure sewer river crossing to sewage treatment plant at Marquette, Mich.

If you were to put *your own money* in a pipeline that should be as nearly permanent as brains, hands and machines could make it, what pipe would you buy? Cast Iron Pipe, undoubtedly! And why? Because cast iron mains are in their *second century* of service in nearly *seventy* cities. *Modernized* cast iron pipe, as made today, is even tougher and stronger. Since everybody pays taxes, one way or another, everybody benefits when you install long-lived cast iron pipe. For further information, write Cast Iron Pipe Research Association, 122 So. Michigan Avenue, Chicago 3.



About four miles of 16-inch Mechanical Joint cast iron pipe being installed for water line at Orlando, Florida.

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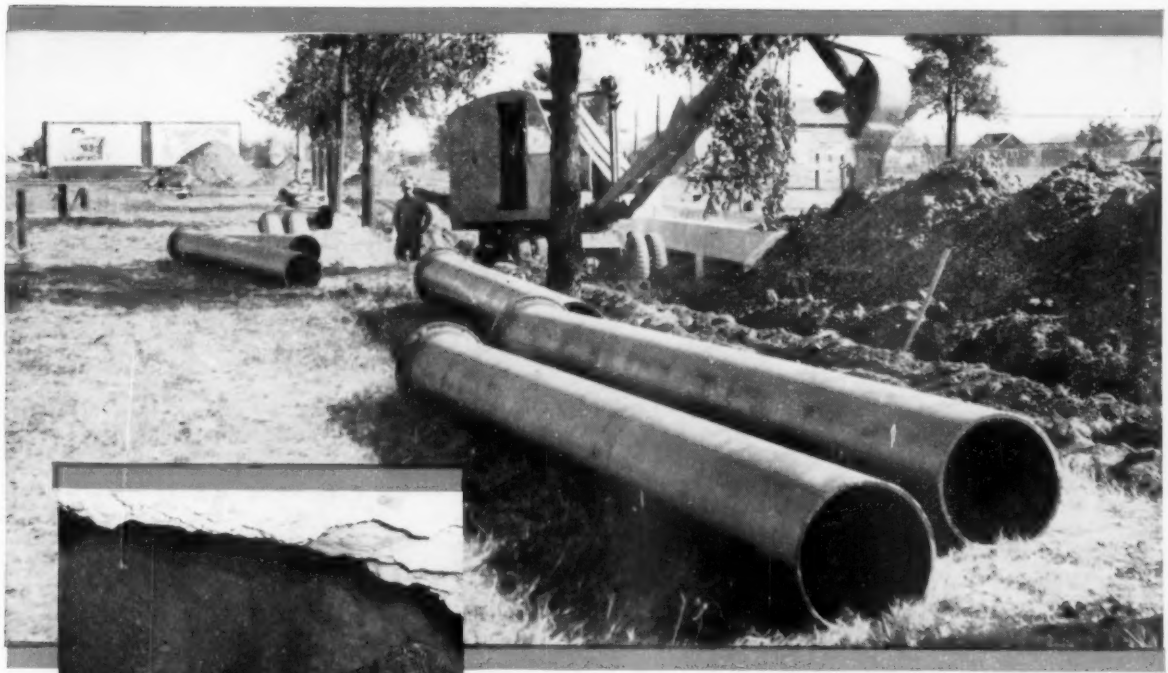
everybody benefits!



Laying 16-inch cast iron pipe for water line to new Caterpillar Tractor Company plant at Decatur, Illinois.

Tieing-in 16" Cement-lined cast iron feeder main with 133-year old cast iron water main in Philadelphia.

Laying 21,000 feet of 6" to 12" cast iron pipe for water main extension at North Brunswick Township, N. J.

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Planning better roads

by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt

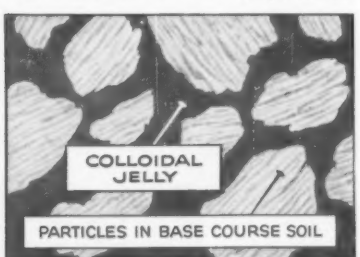
Stabilizing Base Course with Rock Salt Is Efficient, Economical

An increasing number of states and highway departments are now using rock salt to stabilize road base course. The main reason for this is that rock-salt-stabilization gives the base course complete, long-lasting protection against extremes of temperature and weather. Rock salt actually combines with soil to give it added density, water-tightness, and resistance to frost. Result: roads that stand up longer . . . and need less maintenance.

Rock salt provides this remarkable stabilization in three different ways—conforming to severest weather conditions. Here they are:

During heavy rains the salt and clay in the stabilized soil form a colloidal jelly. This jelly acts as a barrier to the seepage of further moisture from any direction. As a result, the stabilized base is actually sealed off from water damage.

In extremely dry weather, salt in the stabilized base recrystallizes and holds the soil fines in place. Thus, the original density of the soil is maintained. This recrystallized salt also shields the road base from heat, helping to preserve necessary moisture in the lower layers. Partially recrystallized salt also fills the natural voids that occur in road base during temperature changes. This is another way "potholing" is prevented.



Rock Salt on the job. Enlarged diagram shows how rock salt forms a colloidal jelly with base-course soil. This protective colloidal jelly is one of the important features of salt-stabilized roads.

In freezing weather, frost cannot readily penetrate rock-salt-stabilized soil. This is because salt acts as an antifreeze, lowering the soil's freezing point. With salt-stabilized base courses, the occurrence and severity of frost heaving are greatly reduced—and resultant surface breakup is minimized.

Economical, too. Another important reason for the growing popularity of rock-salt-stabilization is its low cost. Rock salt itself is an inexpensive and readily available material—and applying it to roads requires no special equipment. This method of stabilization can generally be accomplished quickly and conveniently, too—thus reducing equipment and labor costs. And after stabilization with rock salt, road maintenance expenses are often substantially decreased.

ROCK-SALT-STABILIZATION PERMITS ROADS TO BE BUILT IN STAGES

This is an important feature in many road-building or reconstruction programs. Because the salt-stabilized base course is hard, smooth, and long-wearing—it can successfully be used as the wearing course for as long as several years. When the bituminous or concrete wearing course is finally applied, the base course provides all the advantages detailed here.

This heavily traveled gravel road in the Midwest was stabilized with Sterling Rock Salt, produced by the International Salt Company. Road surface is reported to be hard, smooth, and virtually dustless. It now requires only infrequent maintenance.

Free Technical Assistance on Road Stabilization

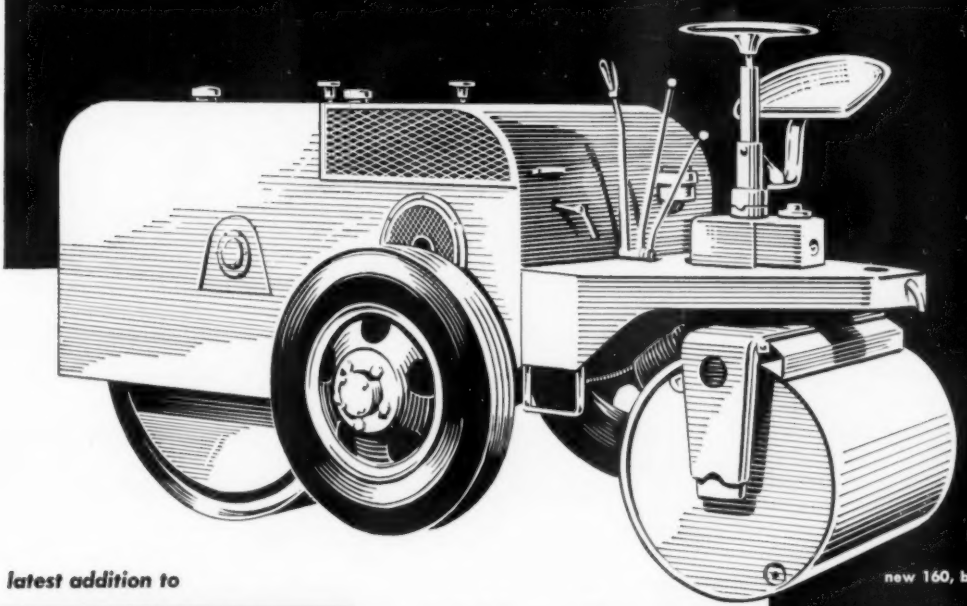
International Salt Company will be glad to help you work out an effective, economical rock-salt road-stabilization program for your system. There's no cost or obligation. Just contact your nearest International sales office.

For further technical information on rock-salt stabilization, write for International's free series of booklets "Better Highways." Address: International Salt Co., Inc., Scranton 2, Pa.

Sales offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; and Richmond, Va.

FOR ROADS, INDUSTRY, FARM, AND HOME—
STERLING SALT
PRODUCT OF INTERNATIONAL SALT CO., INC.

NEW 3·5 TON ROLLER



new 160, bulletin 32

latest addition to

LITTLEFORD **portable roller line**

Out of the Littleford engineering and development center has come the latest addition to the Littleford portable roller line – the new 3-5 ton Model 160 . . . featuring

★ **the first complete power steering** that brings pleasure-car steering ease to this 5-ton giant. No difficult steering lever to grapple with. Mechanical steering in reserve.

★ **hydraulic lift.** Change from trailing-to-rolling-to-trailing positions effortlessly, hydraulically, with a flip of a switch. Wheels need not be removed.

★ **rolling with trailing wheels in position** . . . wheels move up to high position of 5" above rolling surface. Can be removed easily and quickly if necessary.

★ **compaction** when ballasted of 173 lbs./lineal inch on main roll, 91 lbs./lineal inch on small roll.

★ **maximum stability** provided by the 48" diameter x 38" wide main roll and the 30" diameter x 36" wide small roll.

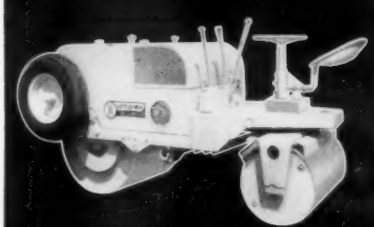
★ **ease of maintenance.** Clutch located outside for easy adjusting.

★ **19.5 hp air-cooled engine** delivers plenty of power when rolling up steep grades and thru soft base material.

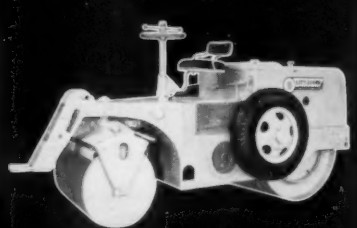
★ **2 speeds forward and reverse.**

Now, with the introduction of the Model 160, there's a Littleford portable roller for every requirement. Send today for descriptive bulletins. Littleford Bros. Inc., dept. LB 215, 452 E. Pearl St., Cincinnati 2, Ohio.

LB LITTLEFORD



Model 157, 2-3 tons, bulletin 24



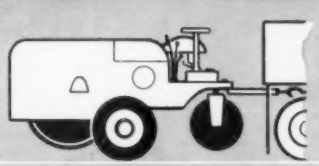
Model 185, 4-6 tons, bulletin 20

world's most complete line of completely engineered black top equipment

HYDRAULIC RAISING AND LOWERING

Unit in normal rolling position.

Hydraulic ram raises pulling tongue to engage towing truck pintle hook.

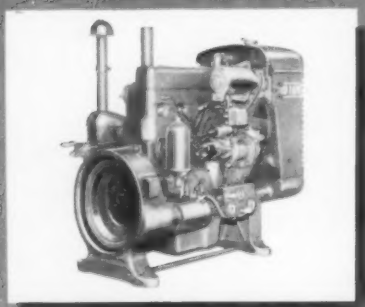


Pneumatic trailing wheels in trailing position with pulling tongue hitched to tow truck.

To get the advantages that only 54 years of engine®

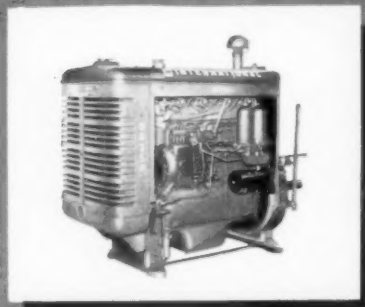
standardize on International

Here are 5 typical members of the International family of 18



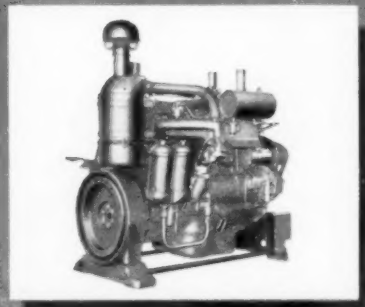
U-169

U-169, rugged 4-cylinder 48.6 hp valve-in-head carbureted unit, delivers top performance on "regular" gasoline. Can be adapted to burn LPG, natural gas, kerosene, or distillate. Ideal for compactors, ⅜-yd excavators, water well drills, fork lifts, rotary snow plows, 12 to 15 kw generators.



UD-350

UD-350, 4-cylinder diesel develops 78.5 bhp as an engine, 75 bhp as a power unit shown above. Available in air compressors, bucket loaders, asphalt mixers and driers, ½-yd shovels and cranes, portable screening plants, 25 to 40 kw generators, hoists, graders, pumps, and trenchers.

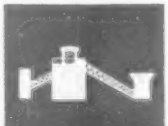


UD-525

UD-525, 6-cylinder, 121 bhp diesel with all-weather push-button starting as standard equipment. Available with 14 major attachments, including 43-gal fuel tank, muffler, skid-type subbase. Fits 29 different excavators, graders, compressors, other construction tools.

International power units in various modifications are engineered to team with all these machines:

Shovels, Cranes, Draglines
17 Manufacturers



Crushers
5 Manufacturers

Motor Graders
5 Manufacturers

Fork Lifts
3 Manufacturers

Air Compressors
5 Manufacturers

Generators
5 Manufacturers

Road Rollers
4 Manufacturers

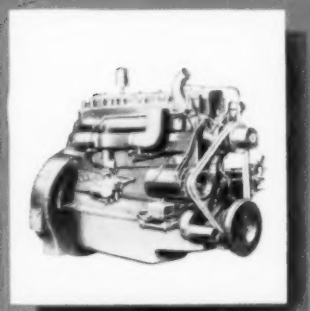
Trenchers
3 Manufacturers

Asphalt Mixers and Pavers
6 Manufacturers

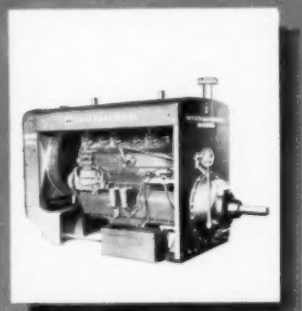
Pumps
12 Manufacturers

leadership can give . . .

Engines



U-450



UD-1091

U-450, one of the most popular 6-cylinder carbureted engines on the market today for trucks, water well drills, 35 to 50 kw generators, graders, ¾-yd shovels and draglines, big rotary snow plows, ditchers and trenchers. Develops 118.5 belt horsepower.

UD-1091, diesel, largest of the 18 International engines, develops 214 bhp, provides exceptional fuel economy for 34 different makes of construction units, including 2 to 2½-yd shovels, 8-cylinder compressors, large asphalt plants and 75 to 100 kw generators.

Engine Model	Displacement (Cubic Inches)	Horsepower (with full equipment less fan)
CARBURETED ENGINES		
U-1	60	17 @ 2500
U-123	123	31.2 @ 2000
U-169	169	48.6 @ 2000
U-264	264	53.5 @ 1600
U-220	220	64 @ 2400
U-240	240	66.5 @ 2400
U-282	282	79 @ 2400
U-372	372	96.5 @ 2200
U-406	406	104 @ 2200
U-450	450	118.5 @ 2200
U-1091	1091	214 @ 1600

Engine Model	Displacement (Cubic Inches)	Horsepower (with full equipment less fan)
DIESEL ENGINES		
UD-264	264	57.5 @ 1800
UD-350	350	78.5 @ 1800
UD-14A	461	100 @ 1800
UD-525	525	121 @ 1800
UD-140-D	525	141 @ 2300
UD-18A	691	131.5 @ 1600
UD-1091	1091	214 @ 1500

In most fields, you'll probably agree, you get the most for your money from the company that's been a leader *for the longest time.*

In engines and power units, the outfit to turn to for longest leadership is International. Since starting manufacture in 1902, International has built and sold *millions of engines* for heavy-duty work! In these 54 years, International has pioneered in developing and perfecting many of the features you consider essential today. Valve-in-head design . . . all-weather diesel starting . . . replaceable cylinder sleeves . . . tocco hardening . . . lubrication through drilled passages . . . precision type bearings . . . full-flow oil filters, to name a few.

These cost-cutting features are backed up with such added advantages as:

Honest horsepower ratings at speeds you can use.

Easy installation with attachments to fit whatever jobs you have.

Fully-experienced sales engineers to help you select and install the engine which best does your work.

Unmatched adaptability, with the same basic engine available as regular or optional power with various modifications in many kinds of equipment (one typical International engine, for instance, fits an International crawler tractor *and 46 makes* of loaders, compressors, asphalt mixers, pavers, excavators, generators, pumps, graders, and rollers). When you power with International, this ready adaptability lessens your parts inventory . . . simplifies and speeds operator training . . . makes your servicing problems a lot easier!

International engine owners get another tremendous benefit, too. To help them is one of the most experienced heavy-duty engine parts and service organizations in the world. At your service are 11 giant regional *parts depots*, 173 Industrial Power *Distributor* locations, *and* hundreds of Power Unit *Dealers*.

To get all these big profit-making advantages, be sure to specify International power. See your nearest Distributor or Dealer for all the facts.

INTERNATIONAL HARVESTER

International Industrial Power

180 N. MICHIGAN AVENUE—CHICAGO 80, ILLINOIS

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Tractor and Rubber-Tired Loaders . . . Diesel and Carbureted Engines

Here's how an "accident" proved the ruggedness of the F&P CHLORINATOR

Here's the true story of how one user decided the modern, rugged Fischer & Porter Chlorinator was his best buy.

"I was impressed with the F&P Chlorinator the minute your field engineer arrived."

"He pulled up to a loading dock in a truck and began to unload the chlorinator. When he had it at the back of the truck, he stopped and got back inside the cab as if to get something and then 'accidentally' let the clutch slip. The truck shot forward and the chlorinaor toppled off the back of the truck and onto the cement floor."

"For a moment we all thought the equipment would smash into a hundred pieces—but it didn't. That just about sold us on it. Of course, we now realize the 'accident' was all part of the demonstration to show us how tough the F&P Chlorinator is."

No other chlorinator is built this way. No other chlorinator can take such punishment. The light weight, fibre glass cabinet is so rugged even such an "accident" won't harm it.

And what's more, this is only one true story of user satisfaction with the F&P Chlorinator. Everywhere users are adding their words of praise for this chlorinator.

In addition to the ruggedness of the unit, you get simplified operation, the absolute minimum of maintenance costs. As one user puts it, "We shudder at the thought of overhauling other chlorinator units, but its a pleasure to bring the F&P unit into the shop. We know it will need very little maintenance work—and any work it does need will be 'child's play,' compared to the time and back-breaking labor spent on other chlorinators."

Users are saying these things. If you're not acquainted with the Fischer & Porter Chorinator now is the time to get complete information. It won't cost you a penny, you won't be obligated in any way . . . and if you like we will arrange an on-the-spot demonstration for you anytime, anywhere. Write today for details. Fischer & Porter Company, 556 Fischer Road, Hatboro, Pennsylvania.

SANITARY LANDFILLS

Recently I was approached by a town superintendent from Schenectady County about including something on sanitary landfills in our next Highway School program. Some of the urban superintendents are concerned with garbage collection and disposal and, I expect, some of the more rural fellows may be concerned with a town dump.

Perhaps you will be willing to give me your advice on a few questions: 1. Would you think that a discussion of sanitary landfills at the Highway School would interest or be of value to all superintendents or just those from urban areas? 2. If so, can a general look at the subject be reasonably handled in, say, a 40-minute talk? We don't discount sanitary landfills but know that the superintendents are most concerned with roads. 3. If you think we might include such a talk in the program, could you suggest a person that might give a very practical, down-to-earth talk outlining: (a) under what conditions is sanitary landfill desirable (b) methods of operation (c) costs.

I know that PUBLIC WORKS has carried quite a few articles on this subject. I am wondering if you have any tear sheets of articles which I might loan to this particular superintendent or other superintendents that may be interested.

I'll appreciate any advice and help you can give me. Many thanks.

J. W. Spencer
Highway Research and
Extension Engineer
Cornell University

WHO HAS MUNICIPAL NEWS REPORTS?

A monthly report is now issued by the City of Midland, Texas, primarily for the information of our City Council and interested business and professional organizations. We feel that the exchange of information between cities as well as the

FULL SPEED AHEAD, AT AN EASY 1400 RPM: The 5 hp air motor of this Ka-Mo drill, here used to tunnel street intersection for a utility line, uses 110 cfm of 100 lb. air to work at full efficiency. To supply this demand, the Jaeger "125" Roto never had to operate faster than an easy, fuel-saving, engine-saving 1400 rpm.

Jaeger "125" Rotary . . . *a more efficient source of portable power*

Because faster-acting controls more closely regulate its engine and compressor unit, the Jaeger Roto Air-Plus® maintains *constant* 100 lbs. air pressure under any demand up to 125 cfm. Operates two 80 lb. breakers, or a 5 hp. earth drill, at their full efficiency. Because it is the most efficient rotary yet developed, air is produced at slower engine speeds (only 1700 rpm full load speed) with proportionate economy in fuel and wear. Tool boxes hold full set of tools, fuel tank holds full 8 hours' supply.

Jaeger Rotaries are built in sizes to 600 cfm. For complete data or demonstration, call your Jaeger distributor or send for catalog JCR5.

50th year JAEGER CONSTRUCTION EQUIPMENT

THE JAEGER MACHINE COMPANY

400 Dublin Avenue, Columbus 16, Ohio

PUMPS • MIXERS • TRUCK MIXERS • SPREADERS • FINISHERS • LOADERS

Puts full wallop into two 80 lb. breakers

Get full details of this month's products . . . mail your Readers' Service card today.

JACKSON VIBRATORY COMPACTORS

TERRIFIC TIME SAVERS ON ALL THESE APPLICATIONS:

BLACKTOP PAVEMENT PATCHING

The manually guided Jackson Vibratory Compactor delivers up to 4200 2-ton blows per minute, is self-propelling and will compact bituminous mixes in 5" layers close to maximum density at the rate of 1800 sq. ft. per hour. Operated from a power plant mounted on an auto trailer with device for quickly picking up and lowering the compactor, this is positively the most advantageous outfit ever offered for patching blacktop pavement, paving drives, walks and similar applications.

It's equally efficient in compacting granular soils in bridge approaches, water, sewer and gas mains and laterals, sub-bases of pavement widening projects, sub-bases of concrete floors, in trenches (interchangeable bases from 12" to 26" available), and dozens of similar applications. 100% of specified density is readily achieved in 10" layers. The Power Plant is fully capable of operating two of these compactors simultaneously and in many instances labor costs can be cut in two by use of the twin-unit shown at right.

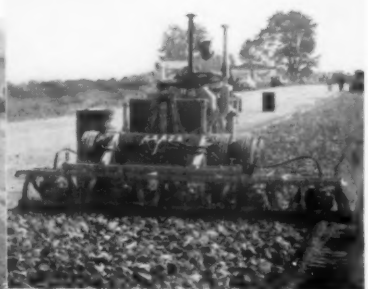
For consolidating base courses of rock, slag, gravel and sand in waterbound and penetration macadam construction the Jackson Multiple Compactor is indeed outstanding. It is used on practically all of the important paving jobs in the nation. By all means write for the complete facts.

TWIN UNIT DOUBLES PRODUCTION

BACKFILL TAMPING

CAMPACTING IN TRENCHES, ETC.

MACADAM CONSTRUCTION



JACKSON VIBRATORS, INC.

LUDINGTON, MICH.

Thousands use our Readers' Service card to keep up to date . . . do you?

various organizations interested in municipal activities will benefit all concerned.

We would appreciate the names of any cities that are issuing reports similar to ours, so that we can exchange our report for their report each month. We hope in this manner to improve our report and also to develop the exchange of information mentioned above.

J. M. Orman
City Manager
Midland, Texas

OPPORTUNITIES IN CIVIL ENGINEERING

Will you please see that I receive six copies of each of the twelve articles on "Opportunities in Civil and Public Works Engineering." My wife, who is doing Guidance Counseling at Central Bucks High School, requested I get her copies if I intend to keep my copies of PUBLIC WORKS intact. . . . We both feel you are doing a real service in the presentation of these subjects.

Leonard H. Point
Township Manager
Warrington, Pa.

Please mail this office ten copies of each of the four articles on "Opportunities in Civil and Public Works Engineering" which appeared in the March issue. We would also appreciate copies of the other eight articles to appear later.

V. L. Fiedler
District Engr., St. Hwy. Com.
La Crosse, Wisc.

The series of articles which you are featuring on "Opportunities in Civil Engineering" is a real fine idea and something that is overdue. I have read the first four articles carefully and rather critically. As you know, I have at various times given a good deal of thought to the problem of interesting graduates in careers in highway work. Attracting good men to this field is difficult. Recently I spent a couple of hours of valuable class time talking this situation over with students in my graduate class in Transportation Engineering at Northwestern. Not one of the new graduates was interested in working for the State Highway Department, though two or three others in the class are already doing so.

What will attract a good man? My own conclusion is that the primary motive of most young graduates in selecting a first job is *assurance* of opportunity—opportunity for growing in salary, responsibility and rec-

(*Continued on page* 208)

TAKES OBSTRUCTIONS IN STRIDE

HAS GOOD OPERATOR VISIBILITY

OUTRIGGERS LEVEL UNIT

FORMED PLATE BOOM AND STICK

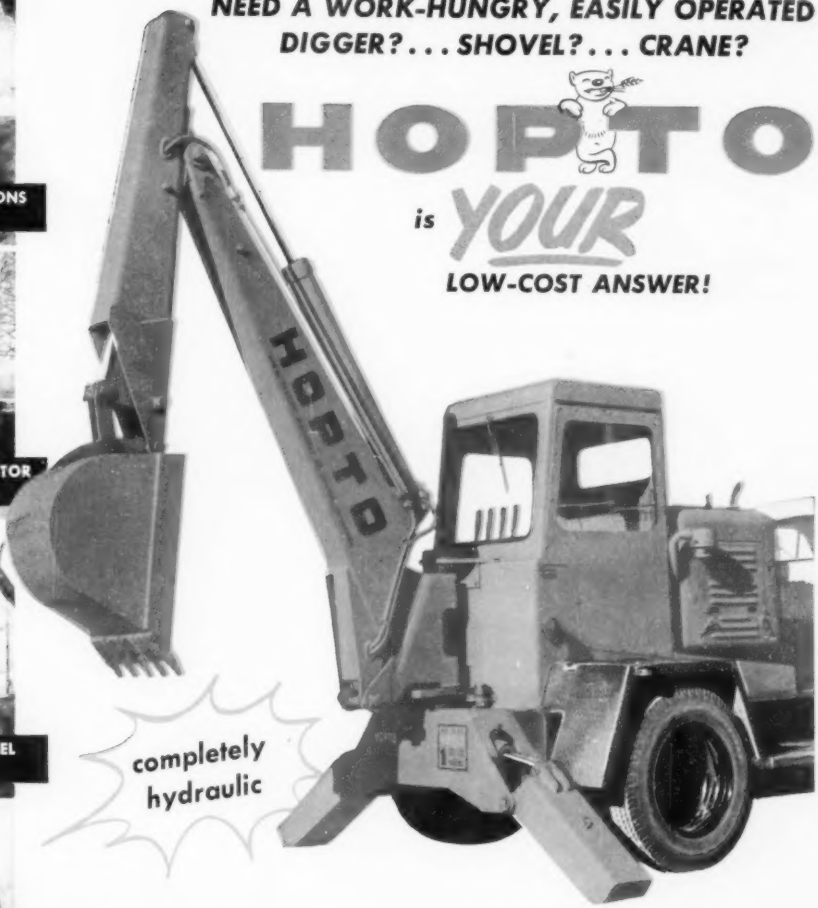
SHOVEL BUCKETS FOR EVERY PURPOSE

DUMPS AT 11 FEET

NEED A WORK-HUNGRY, EASILY OPERATED DIGGER?... SHOVEL?... CRANE?

HOPTO

is **YOUR** **LOW-COST ANSWER!**

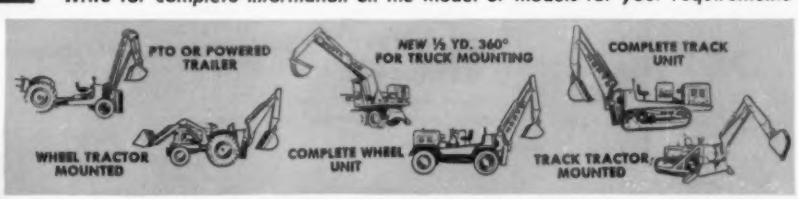


Here's the fast cycling, 200° swing, *completely* hydraulic digger-shovel-crane that reaches out for work! HOPTO has a 16½′ reach at ground level *beyond* the boom mounting; digs more than 11′ deep and dumps at 9½′ with backhoe and 11′ with shovel bucket! ! ! It's the easy-to-operate unit your handy man will handle like a veteran in half a day!

HOPTO mounts on *any* ton-and-a-half or larger truck. Hydraulic outriggers level unit and take load from truck chassis and springing mechanism! Feather-touch controls in the full visibility cab actuate every movement of unit *and* outriggers. No belts, pulleys, cables or sheaves on a HOPTO! It's *completely* hydraulic!

The 1500 PSI hydraulic system has overload relief valves, double wire braided hoses, 5″ inside diameter hydraulic cylinders with 2⅜″ chrome plated piston rods, and a large oil reservoir for most efficient operation! Self aligning bearings and hardened alloyed steel pins . . . formed steel plate boom, stick, and sub-frame . . . direct mounting of pump on power unit . . . crowd cylinder *above* boom . . . these are but a few of the many *long-life*, *low-maintenance* features of the quarter-yard, work hungry HOPTO.

Write for complete information on the model or models for your requirements



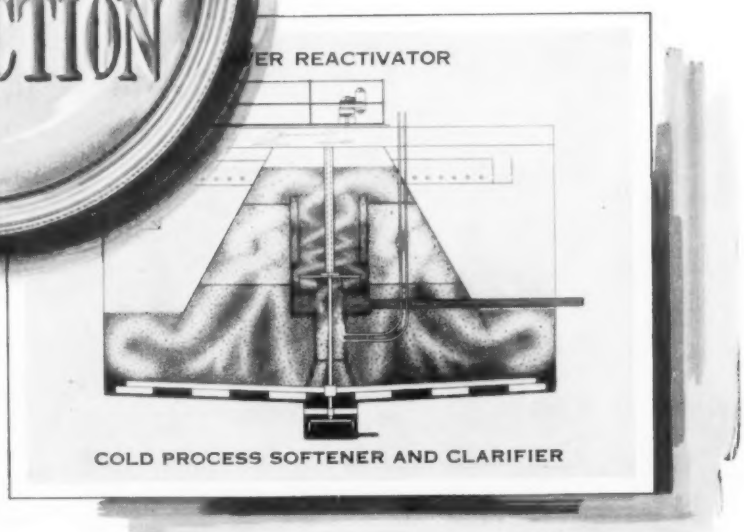
MANUFACTURERS OF A COMPLETE LINE OF ½ YARD AND ¼ YARD HYDRAULIC DIGGER—SHOVEL—CRANE

BADGER MACHINE COMPANY

1124 WEST 5th STREET • DEPT. P • WINONA, MINNESOTA

Now's the time to mail this month's Readers' Service Card.

DESIGN of DISTINCTION



*See models of the Reactivator at our exhibit, Booths 127-28, at the AWWA Convention, Kiel Auditorium, St. Louis, Mo. May 6-11.

The distinctive design of the Graver Reactivator®, proven in hundreds of installations, combines *all* four of these important features in *one* unit: *1. Controlled Sludge Recirculation, 2. Separately driven Sludge Scraper, 3. Low Sludge Level, 4. Sludge removal over entire bottom area*

WRITE FOR
DESCRIPTIVE
CATALOGUE
WC-103A

GRAVER

Municipal Dept. M-113
GRAVER WATER CONDITIONING CO.
A Division of Graver Tank & Mfg. Co., Inc.
216 West 14th Street, New York 11, N. Y.

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

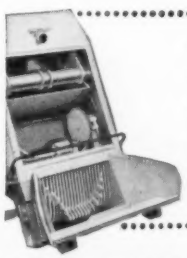
FIRST AND ONLY COMPLETE LINE *of Refuse Collection Equipment!*

LOAD-PACKERS® The original packing-type refuse collection units! Preferred by over 2600 municipalities for fast loading, positive compaction, low maintenance costs, better service. Fully hydraulic for long life . . . fully enclosed for greater sanitation. Unmatched for narrow alley operation. Write for booklet W-171 that describes all six Load-Packer models, with capacities from 10 to 24 cubic yards.

SPEED-PACKERS® First continuous loader that crushes, shreds and compacts to handle far greater payloads! Non-selective... handles tires, lumber, concrete blocks, tree limbs, anything the Speed-Packer can get its 46 teeth into. Exceptionally low maintenance costs . . . combines speed with safety. New 16 and 20 cubic yard models are described in booklet W-195. Write for your copy.

Never before has it been so easy to add new collection equipment to your present fleet! You can choose from one complete line of sizes and types to meet your exact municipality or private contractor requirements. All models are built and backed by Gar Wood, the originators of packing-type collection equipment. All are designed for low maintenance costs . . . many parts are interchangeable. All are sold and serviced by one world-wide organization of leading truck equipment distributors.

Find out how you can best meet the growing collection needs of your municipality with the world's first and only complete line of equipment. Call your Gar Wood-St. Paul truck equipment distributor, or write to: Customer Service Department, Gar Wood Industries, Inc., Wayne, Michigan.



NEW SPEED-PACKER TAILGATE Available as Replacement Part!

Your present LP-216 and LP-220 Model Load-Packers can be easily converted into continuous loaders. Ask your dealer about Gar Wood's revolutionary Speed-Packer Conversion Plan.

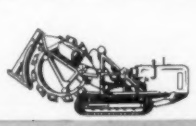
GAR WOOD INDUSTRIES, INC.

Wayne, Michigan • Richmond, California

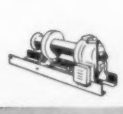
Plants in Wayne and Ypsilanti, Mich.; Findlay, Ohio; Mattoon, Ill.; Richmond, Calif.

GarWood

Gar Wood-St. Paul Hoists & Bodies



Gar Wood-Buckeye Ditchers



Gar Wood Winches

Gar Wood-Buckeye Spreaders

for more production

wide work range

low job costs

Set your sights on an HD-6B

45 drawbar hp–55 belt hp–12,400 lb

on-the-job advantages important to

All-steel, box-A main frame — soaks up shock loads.

One-piece steering clutch and final drive housing — line-bored for true alignment of shafts and gears.

Straddle-mounted final drives — with bearings on both sides of gears to maintain gear tooth alignment.

Heavy-duty truck frames — keep tracks in line, reduce wear . . . help get more work done at lowest possible cost.

Allis-Chalmers long-life diesel engine — with follow-through combustion that delivers power for big output with ample power reserve.

Simplified lubrication — including 1,000-hour lubrication intervals for truck wheels, idlers, and support rollers . . . provides extra working time.

Get full details of this month's products . . . mail your Readers' Service card today.

and all these exclusive owners and operators:

Unit construction — makes service easier, faster . . . major units can be removed without disturbing adjacent assemblies.

Operator ease and comfort — with foam rubber seats . . . responsive controls . . . full visibility.

Wrap-around radiator guard — serves as dozer lift frame . . . reduces weight and cost, produces superior balance for tractor-dozer.

Engine-mounted bulldozers — direct lift . . . positive down pressure . . . hydraulic straight blade or angle blade.

Plus heavy-duty, tapered roller bearing truck wheels, heavy-duty truck wheel guards, 24-volt direct electric starting, crankcase guard, bumper, and lights at no extra cost.

Check the complete service program offered by your Allis-Chalmers Construction Machinery dealer. His factory-trained servicemen, factory-approved facilities, and stocks of True Original Parts keep your equipment operating properly . . . add up to the kind of service that saves you money.

See your Allis-Chalmers Construction Machinery dealer. He will be glad to show you an HD-6B at work.

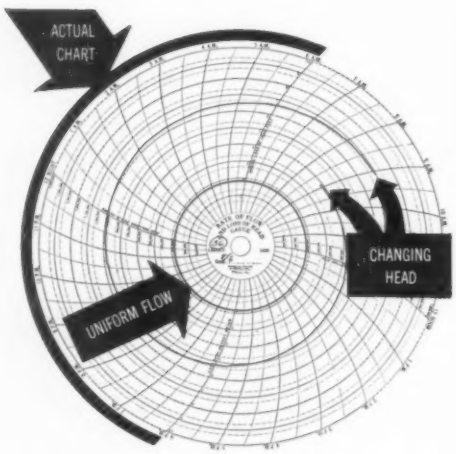
ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

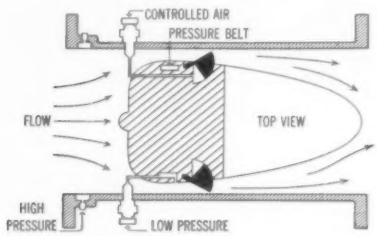
Thousands use our Readers' Service card to keep up to date . . . do you?

NEW SIMPLEX FILTER RATE CONTROLLER GIVES YOU COMPLETELY PNEUMATIC CONTROL!

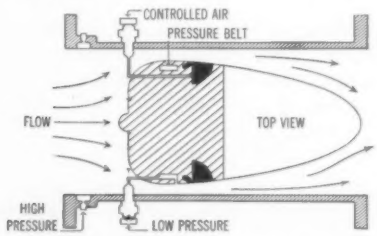
Amazing Modulair® Controller responds fast... closes tight



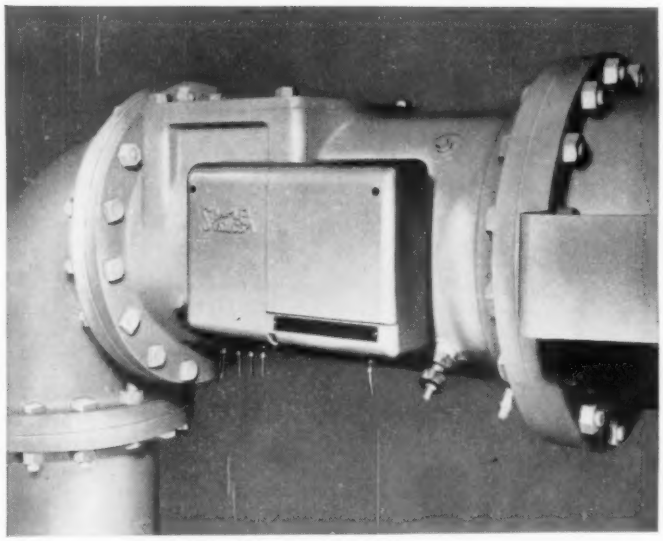
Here's proof that the new Simplex Modulair Filter Rate Controller responds instantly to changes in filter head, holds flow at desired rate . . . automatically! In chart from Modulair installation No. 2, head changes from 4′ to 7′ while rate forms almost perfect circle at the set 275,000 gpd.



How Modulair works! Pipe-like casting with annular Venturi throat houses streamlined inner body with corded-rubber modulator (black) that expands and retracts pneumatically to control flow. When head is low at start of run, modulator expands automatically to hold flow at set rate.



As filter head loss rises, flow tends to decrease . . . and change the Venturi differential. Sensitive Modulair compensates by instantly retracting the pneumatic modulator, maintaining a constant head-loss value through the combined filter and controller, automatically keeping flow at set rate!



Compact . . . easily installed Modulair is only two to three pipe diameters long! It fits wherever a piece of pipe can fit . . . in any position, horizontal or vertical . . . simplifying pipe gallery layout. High-grade, cast iron Modulair comes in 4" to 24" standard pipe sizes with corrosion-resisting fittings. Cord-inserted rubber throttling element that's as tough as a truck tire has given 30 years' wear in accelerated life-tests.

Accuracy! In 4 years of field performance, Modulair charts show an accuracy in filter control that exceeds today's most exacting demands. This high degree of control extends for wide ranges of head loss and flow rates, including complete, tight shut-off! And there's no drift at end of run.

Longer filter runs! Modulair combines a low head-loss, annular Venturi measuring element with a streamlined throttling element. This new design offers so little resistance to flow that you get longer filter runs, big savings in wash water!

Minimize maintenance! With Modulair's new design, there's no place for air to accumulate . . . no place for sand to lodge and interfere with accuracy. Throttling element, the only moving part inside pipeline, is non-corrosive rubber. Pneumatic poise element is simple, rugged. There are no line valves, no pilot valves, no pistons, no valve shafts, no stuffing boxes to pack!

Lower first cost! Modulair's low head loss means lower operating head requirements . . . permits vertical compression in plant design and lower costs in plant construction.

Completely pneumatic! No intermediate hydraulic steps! No pilot valves! No hydraulic cylinders! Air loading pressure is applied *directly* to the flow controlling element.

Automatic filter operation! Modulair works with control systems of any type to give you remote rate control or master pneumatic control that's fully automatic.

Technical bulletin! For full details on Modulair, write for Bulletin 950. Simplex Valve & Meter Company, Dept. PW-5, 7 East Orange Street, Lancaster, Penna.

Accurate instruments and controls for over 50 years

SIMPLEX®

VALVE AND METER COMPANY

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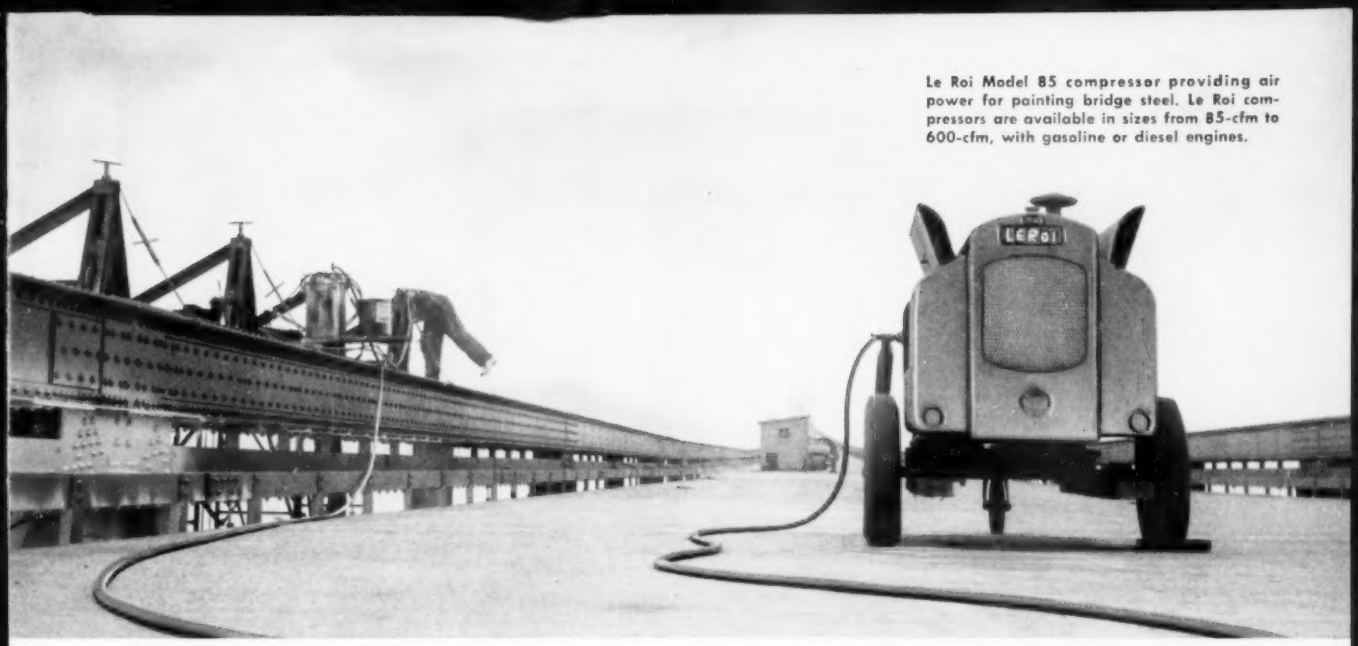


Le Roi Model 85 compressor providing air power for painting bridge steel. Le Roi compressors are available in sizes from 85-cfm to 600-cfm, with gasoline or diesel engines.

4 Million Cubic Feet of Air Power per Day Speeds New Bridge Construction

Le Roi Airmaster Compressors provide power for sand-blasting and spraying 46,000 gallons of paint on new 21,243-foot bridge.

Also use Le Roi airpower on construction work at water level.

Working air power, in the yard, on the deck, and at water level, totals about 4 million cfm a day.

Nearly 200 feet above San Francisco Bay, a fleet of Le Roi compressors provides 95% of the air power for spraying 46,000 gallons of paint on new bridge steel. The project is a $62 million bridge to span 4.4 miles of windswept water. It will link the cities of Richmond and San Rafael, California.

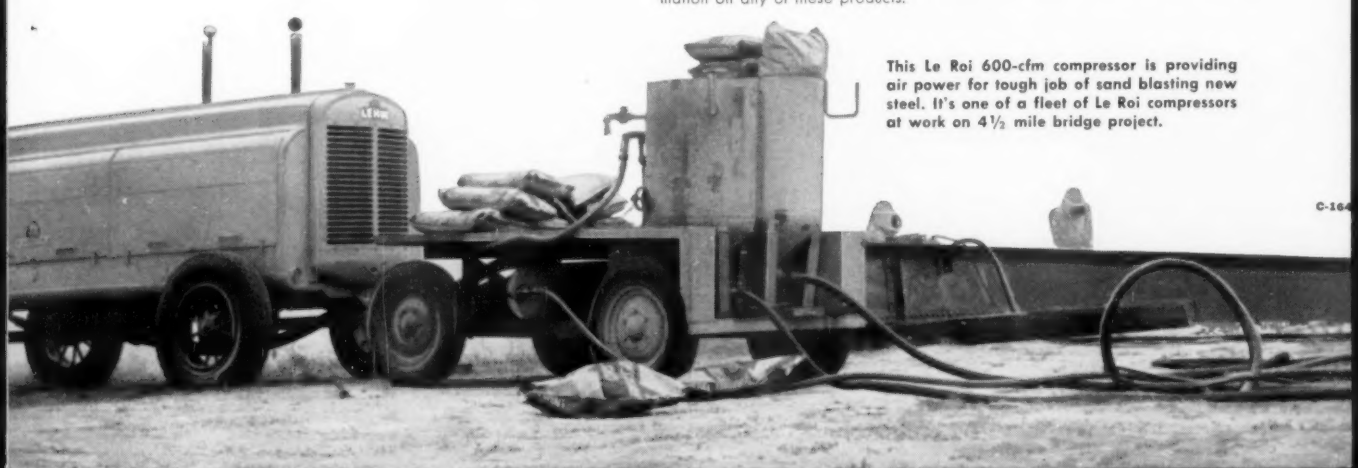
Compressors exposed to elements. High up on the bridge structure, Le Roi compressors are exposed to cold, moist, salt-laden winds. Only equipment designed for the toughest construction work can give top performance under these conditions — another reason why contractor D. E. Burgess uses Le Roi compressors to spray 46,000 gallons of paint on four miles of bridge steel.

Sandblasting is rugged work. Back in the yards, Le Roi compressors are also providing air power for sand blasting. It's tough, continuous work . . . fills the air with abrasive dust. Yet Le Roi compressors keep a steady flow of air power at work. They're easy to start, too. That's why more than a dozen compressors are used on this enormous and important project.

Prime contractors on this bridge project are Judson Pacific, Murphy, Kiewit. Upon completion, it will be the world's second largest bridge surpassed only by the famed San Francisco Bay bridge.

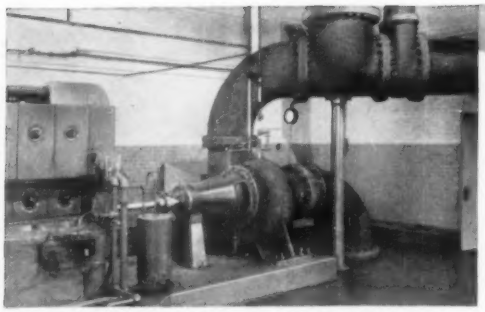
Le Roi's are designed for dependability. Le Roi compressors were chosen for this big project because they combine long service, good fuel economy, low cost maintenance, and deliver more cool, clean air for less money. Valves are interchangeable and accessible for quick, easy maintenance. You also get more generous cfm with lower rpm. Lower rpm means lower speed — the result, less heat, less wear, and less fuel.

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.



This Le Roi 600-cfm compressor is providing air power for tough job of sand blasting new steel. It's one of a fleet of Le Roi compressors at work on 4½ mile bridge project.

C-164



MDC Quincy (sewage): Twin 20" F-M "Angle-flow" pumps are driven by F-M diesels in this station recently converted from steam power.

MDC Charlestown (sewage): Two F-M diesels drive 36" F-M vertical pumps. The engines also drive 20 kw. F-M generators.

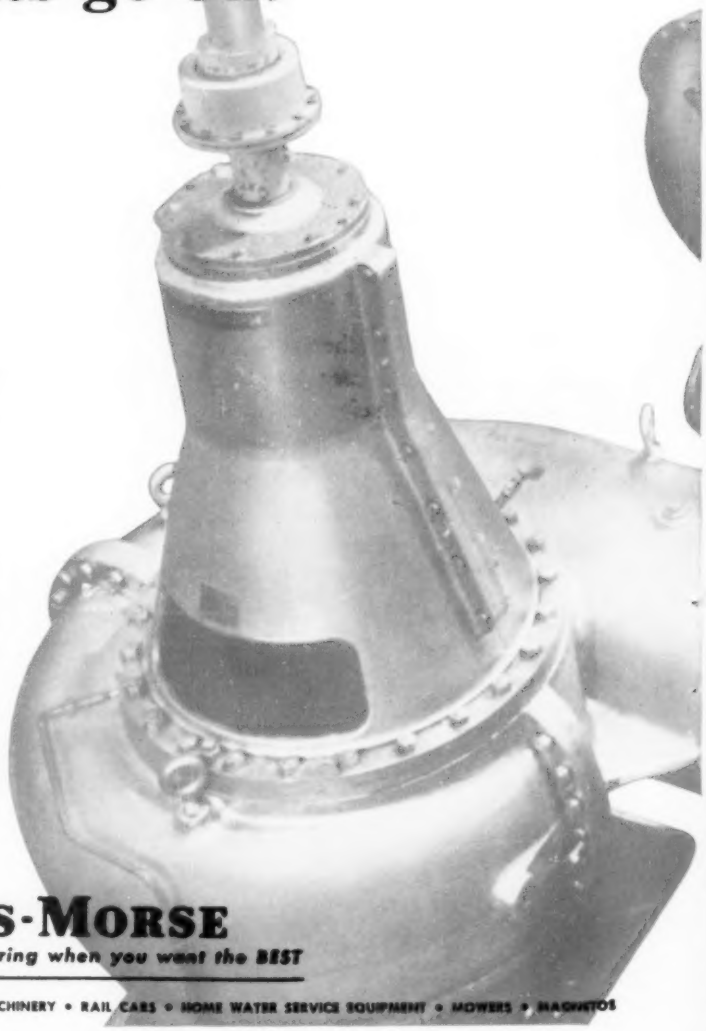
When the lights go out

...MDC keeps pumping. MDC is the Metropolitan District Commission, an organization which exists to provide coordinated municipal services, parkways and recreational facilities for Boston and many of the cities and towns which are integrated in the metropolitan area.

Many of MDC's water and sewage pumping stations are completely self-sufficient. Others, dependent for normal service on utility electric power, have stand-by power of their own—just in case the lights go out.

Fairbanks-Morse has supplied the driving as well as the driven member in many MDC installations. F-M diesels drive F-M pumps in continuous service. Other F-M pumps are driven by F-M motors. Still others, diesel powered, are standing by for the possible emergency.

Whatever your problem in municipal pumping, Fairbanks-Morse has the pump . . . and the driver . . . and the engineering to solve it. Fairbanks, Morse & Co., Chicago 5, Illinois.



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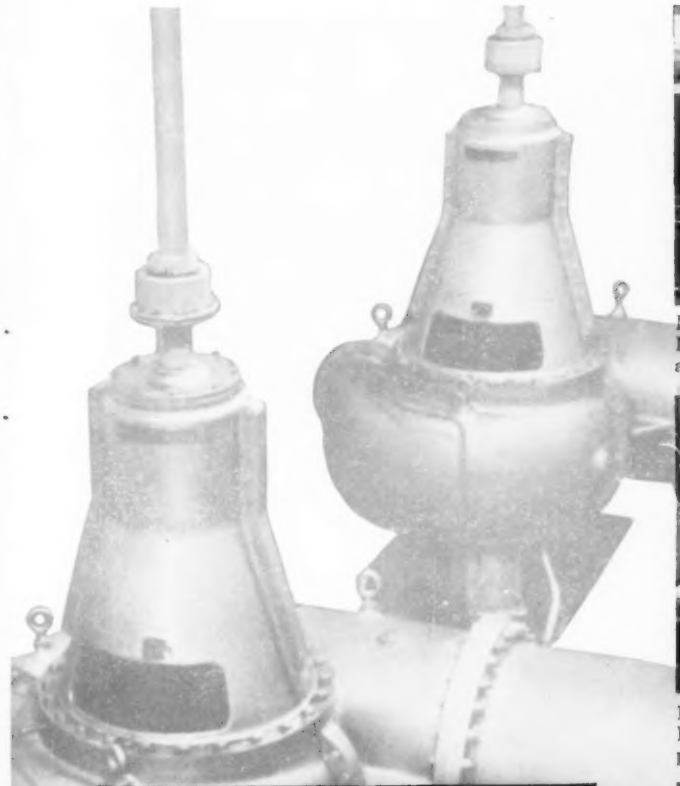
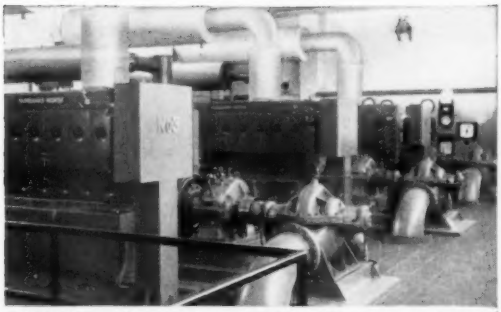
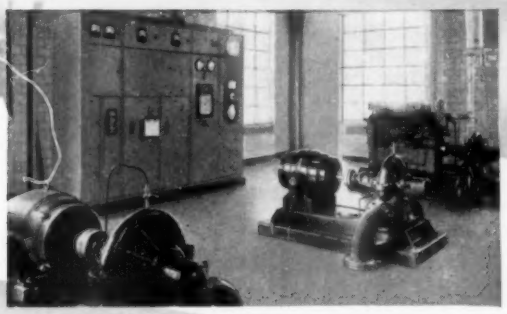
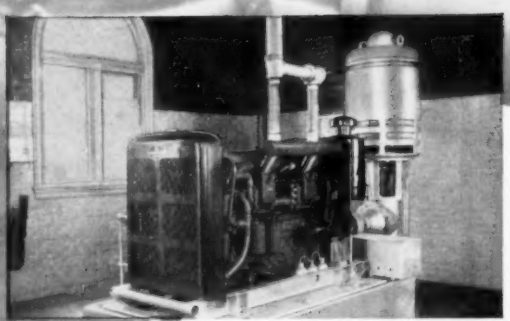




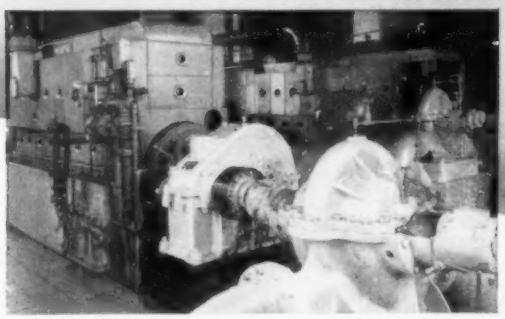
MDC Brookline (water supply): The new station on Newton Street houses three F-M centrifugal pumps and three F-M diesel engines.



MDC Waltham (water supply): F-M pumps and F-M motors fill routine demands. A third pump, powered by an F-M diesel, stands by for emergency.

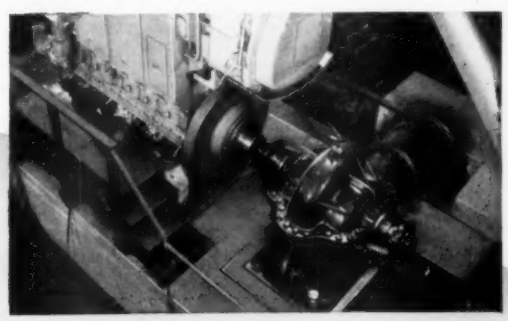


MDC Reading (sewage): In this two-pump (F-M) station, an F-M diesel can take over in the event of power failure to the 100 hp. F-M electric motor.



MDC Arlington (water supply): In a station recently converted from steam power, Fairbanks-Morse centrifugal pumps are driven by F-M diesels.

MDC Alewife Brook (sewage): In this new all-electric pumping station, two 36" and one 16" F-M "Angleflow" pumps are motor driven from the floor above.



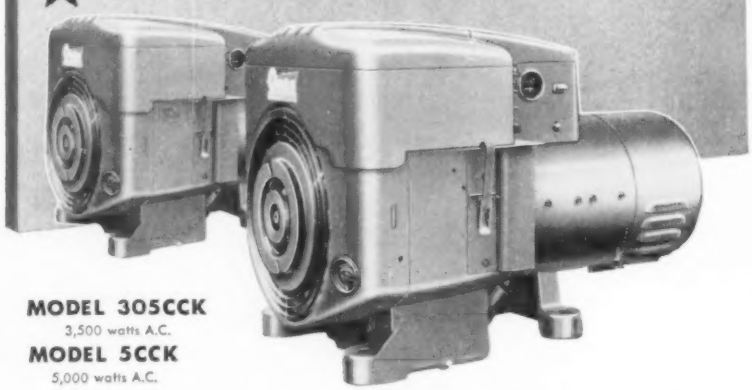
MDC Spot Pond (water supply): A 20" F-M centrifugal (illustrated) and a 36" F-M turbine, driven by F-M diesels, are taking over from steam.

Wherever you need a 3½ or 5KW power package

New ONAN CCK Electric Plants

give you more of what you want most!

★ MORE OUTPUT PER POUND OF WEIGHT
★ MORE OUTPUT PER GALLON OF FUEL
★ MORE OUTPUT PER DOLLAR COST!



MODEL 305CCK
3,500 watts A.C.
MODEL 5CCK
5,000 watts A.C.

Powered by longer-life, short-stroke engines

Onan has wrapped up all the time-tested Onan quality features with outstanding new design advances in these versatile power packages. Measure them by any standard . . . put them to work on any job . . . and you'll rate these new Onan units as leaders in value, way-ahead in performance.

More powerful, two-cylinder, air-cooled Onan engines of 4-cycle, horizontally-opposed, alternate-firing design, give smooth, quiet, effortless performance. Short stroke and moderate speed cut engine wear, give longer life. Quality features include rotating Stellite-faced exhaust valves, solid Stellite valve seat inserts and full pressure lubrication.

For difficult installations . . . in a closed compartment or "buried" within a vehicle, Onan's exclusive Vacu-Flo cooling system is available as an optional feature.

Like all Onan Portable Electric Plants, CCK units are completely Onan-built, with Onan engines direct-connected to Onan all-climate generators in compact, rugged units. Available in stationary, portable and standby models with a wide range of accessories giving them all-around versatility.

PORTABLE MODELS Equipped with carrying frame as shown or mounted on 2-wheel, rubber-tired dolly, the CCK makes a high-capacity, easily portable, package of electric power. Other Onan models: 500 to 50,000 watts.

Special folder describes 12 new CCK models. Write today.

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Paul Weir has been General Manager of the Atlanta, Ga., Water Department since 1947. In all, he has been with the Department twenty-four years. For eleven years he was Superintendent of Water Purification and for five years Assistant General Manager. He has done a remarkable job in developing a water system to meet the needs of rapidly growing Atlanta, one of the fine cities of the South. Mr. Weir was graduated from Georgia School of Technology in 1928 with the degree of CE and is a registered professional engineer.

Paul has been active in water works organizations and is currently the President of the American Water Works Association, a position he has merited by years of fine service in state and sectional groups, as well as in the national organization; and he has been the recipient of many honors and awards. He is also a member of ASCE and is a past president of the Georgia Section; and also of the Georgia Engineering Society. He is a past director of the Natural Resources Division of the U. S. Chamber of Commerce.

A Correction and An Apology

On the front cover of our April issue we showed a picture of Marsden C. Smith and, in error, termed him "Director of the Department of Public Utilities." J. Edward Metzger is the Director of Public Utilities of Richmond, Va., and has been for some years; Mr. Smith is Chief Water Engineer of the Department. We regret this error and tender our apologies to both Mr. Metzger and Mr. Smith

SEE THE Forty Five BEFORE YOU BUY

Here's motor grader design that pays off in extra output on today's tougher, more precise jobs. You get these big advantages when you put the FORTY FIVE to work for you—more power at the wheels, more dirt at the blade, plus precision control and ease of operation.

Allis-Chalmers diesel engine with follow-through combustion provides real lugging ability . . . responds quickly to varying load conditions . . . has the power with tandem drive to pull through soft spots, roll big windrows, peel off that last inch of tough, hard dirt.

ROLL-AWAY moldboard reduces friction drag by rolling the load up and ahead of the blade edge . . . moves more dirt with less effort . . . makes more efficient use of engine power on sloping, rough grading, stripping and other heavy-duty construction and maintenance jobs.

Toggle-type controls give the operator finger-tip command of every blade position, every job. Exclusive mechanical toggle-type action provides a positive "feel," yet operation of moldboard components, scarifier and front wheel lean is accurate and easy.

Get a demonstration of the FORTY FIVE from your Allis-Chalmers dealer . . . let him show you how fully-enclosed power steering, accelerator-decelerator pedal, "box seat" comfort and visibility, and other features give you an extra measure of performance on all your grading jobs. Check the complete service program he offers you . . . factory-trained servicemen and True Original Parts for high-quality service, continued top performance and long equipment life.

Forty Five
120 brake hp
23,800 lb
6 forward speeds to 20.6 mph
3 reverse speeds to 7.0 mph

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

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are used in

Trickling Filters

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The essentials are the same for all trickling filters; for low rate or high. For large volume or small. The basic, properly designed trickling plant is capable of meeting all requirements—present and future—within foreseeable limits.

TRICKLING FILTERS COMBINE THESE 6 BIG ADVANTAGES

1. LOW COST. First costs are reasonable, and low-cost operation will save your community money.
2. SIMPLE, EASY OPERATION. In most plants one man in a 40 or 44-hour week can do the work.
3. LONG LIFE—longer than the life of the bonds issued to pay for them.
4. GOOD RESULTS—top notch effluent—say 20 ppm BOD, day after day, year after year.
5. RELIABILITY distinguishes their performance always.
6. OVERLOAD IS NO PROBLEM. Take temporary shock loads—or those of a new industry right in their stride.

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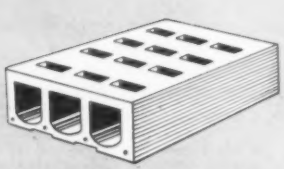

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W. S. Dickey Clay Mfg. Co.
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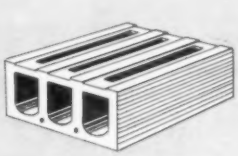
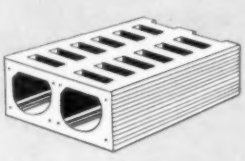
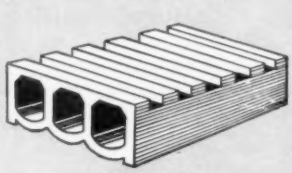
Kansas City 6, Mo.



POMONA
Pomona Terra-Cotta Co.
Pomona, N. Car.



ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



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Texas Vitrified Pipe Co.
Mineral Wells, Texas.

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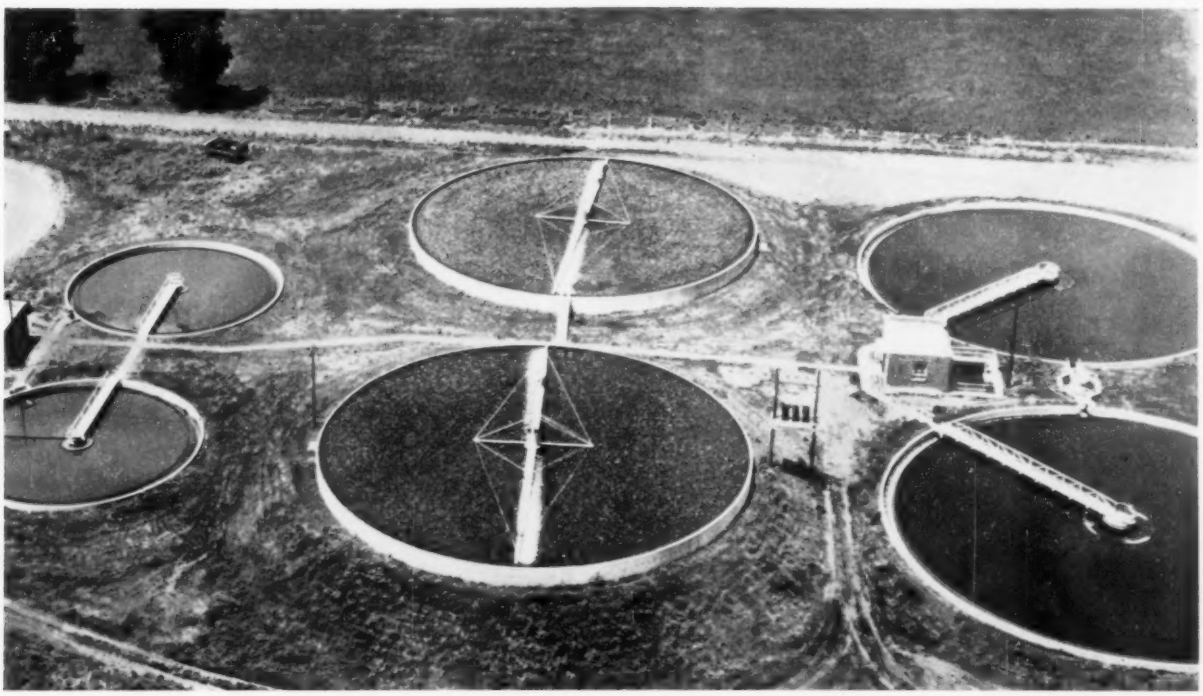
Wilson & Co., Consulting Engineers, Salina, Kansas
Contractor, Brown & Johnson Construction Co., Salina, Kansas

Major equipment includes two 65' Dorr primary clarifiers plus Dorr-Oliver distributors, clarifiers and primary digester



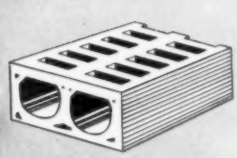
Modern trickling filter plant at Salina, Kansas

You can be sure it's the best if you use a trickling filter with TFFI underdrain blocks specified

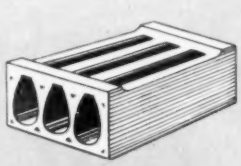
SPECIFICATIONS

Standard Specifications for Vitrified Clay Filter Blocks for Trickling Filters are given in full on pages 37 and 38 of the 1954 revised edition of the HANDBOOK OF TRICKLING FILTER DESIGN. These specifications cover types of blocks, compressive strength, absorption, shape, permissible variations, apertures, shell and and web thickness, drainage channels, workmanship, markings, testing—everything that an engineer needs to write specifications for trickling filter blocks. Secure your copy from any TFFI member listed below.

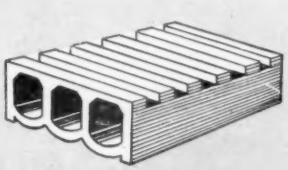
FLOOR INSTITUTE



BOSCO
Bowerston Shale Co.
Bowerston, Ohio



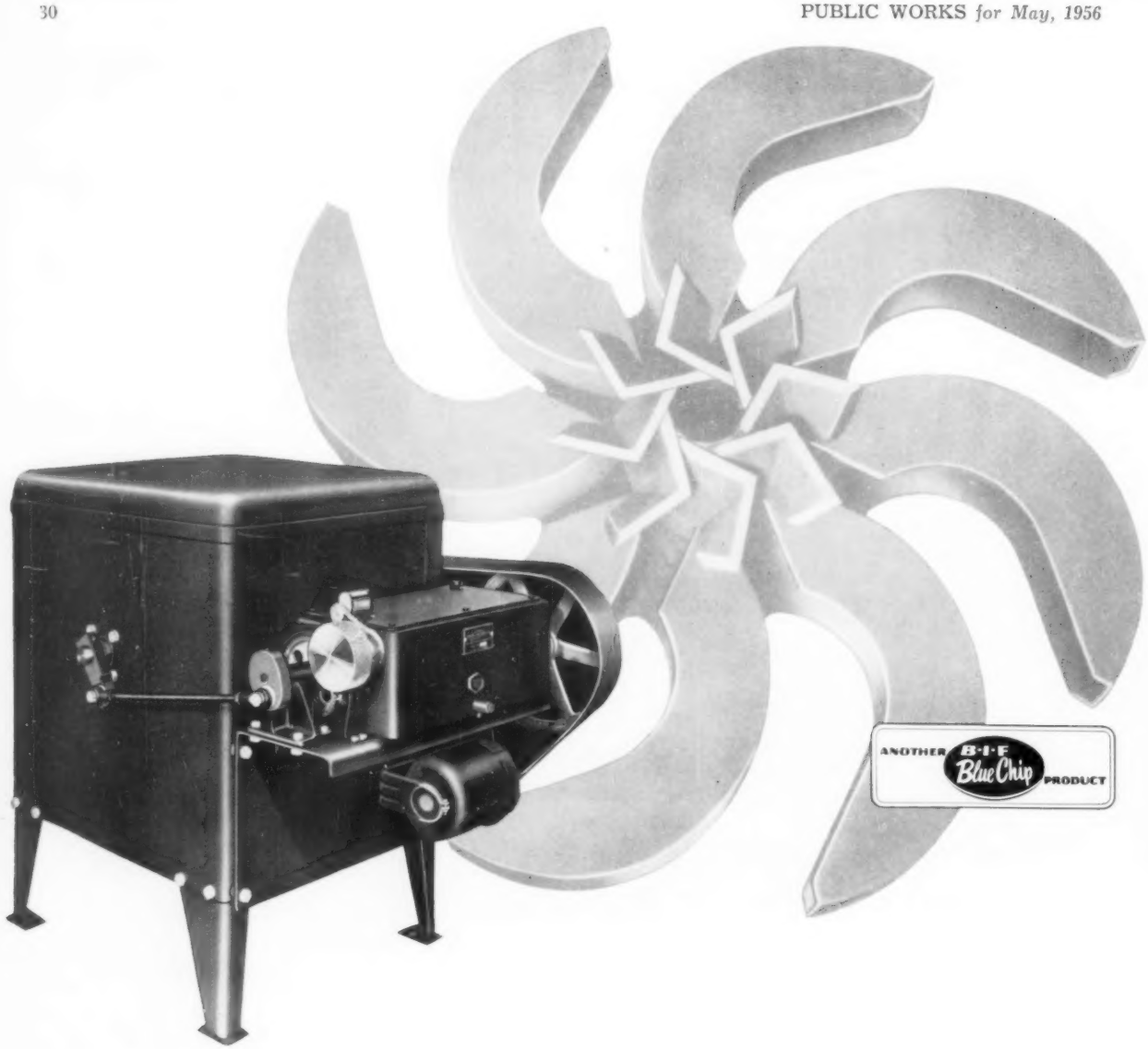
NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.

TFFI

Symbol of
good treatment



THE WHEEL OF FORTUNE FOR LIQUID CHEMICAL FEEDING

Because of its unique rotary dipper wheel, the Omega Rotodip Liquid Feeder is the low-cost, low-maintenance answer to many liquid chemical feeding problems. Rotodip sure pays dividends on feeding jobs like these: carbon slurry for taste and odor control . . . liquid alum for coagulation or sulfuric acid for pH control . . . ferric chloride feeding for sewage sludge conditioning. Consider the many advantages which are yours in using a Rotodip: wide-range adjustability (100 to 1) — high repeatable accuracy (within 1%) — complete simplicity (very low on maintenance) — easy adaptability to automatic control systems — direct-reading gallon-by-gallon totalizer.

Send for new Bulletin 65-H12A . . . a detailed description of this accurate and efficient feeder. Omega Machine Co., 356 Harris Avenue, Providence 1, R. I.

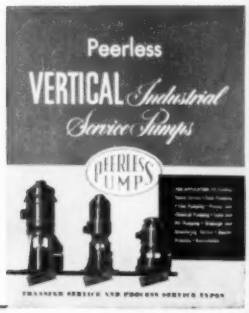
OMEGA *THE LAST WORD IN* FEEDERS

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • BUILDERS-PROVIDENCE, INC.

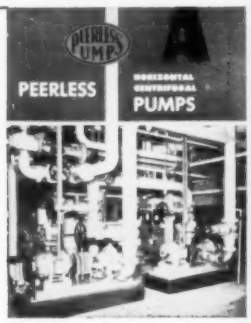
METERS
FEEDERS
CONTROLS

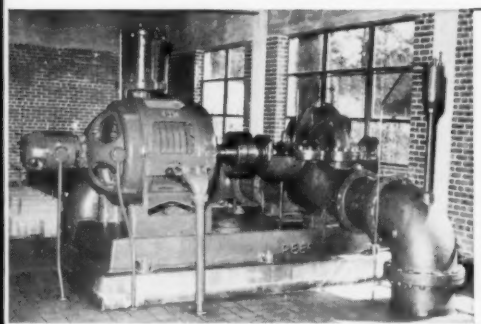
look AT THE PUMPING PROBLEM *two ways*



VERTICAL

HoRizontal





PEERLESS PUMP DESIGNS PROVIDE THE RIGHT TYPE FOR DOING THE JOB BETTER

You pick the design; Peerless will supply the pump. From one of the broadest range of pump capacities, heads, horsepowers, you can choose a Peerless horizontal or a Peerless vertical pump for almost every liquid transfer job, involving either water or process liquids.

In the picture at the top above, a concentrated solution of sulphuric acid and aluminum sulfate is being pumped by Peerless vertical industrial service pumps. To find out all about them request Peerless Bulletin No. B-505.

The Peerless horizontal type A pump shown just above, is one of three that supplies plant water for a textile mill. To find out all about them request Peerless Bulletin B-1300 and B-1350.

Use the coupon below to find how these Peerless designs can meet all your pumping needs with economy, efficiency and dependability.

PEERLESS PUMPS

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles 31, Calif., and Indianapolis 8, Ind.

Offices: New York; Atlanta; Chicago; St. Louis; Indianapolis, Ind.; Phoenix; Fresno; Los Angeles; Plainview and Lubbock, Texas; Albuquerque, New Mexico.

Distributors in Principal Cities. Consult your Telephone Directory.

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, California

Please send bulletins checked below:

- ☐ PEERLESS INDUSTRIAL SERVICE PUMPS (B-505)
- ☐ PEERLESS TYPE A HORIZONTAL PUMPS (B-1300)
- ☐ AND TYPE AS (B-1350)

NAME_____

COMPANY_____

ADDRESS_____

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PW

Thousands use our Readers' Service card to keep up to date . . . do you?

CALGON* Stops Red Water!

MANY visitors to the AWWA Convention in St. Louis will know from their own experience that Calgon really controls Red Water, as demonstrated by the Calgon exhibit shown above. Water Superintendents from coast to coast have found that Calgon is the easiest and least expensive way to stabilize dissolved iron and manganese and *to inhibit corrosion† and tuberculation in* iron pipes.

Calgon is effective against lime scale formation, too, and stabilizes lime soda softened water to control calcium carbonate precipitation.

Why not stop by the Calgon booth and find out how Calgon can help you?

*Calgon is the Registered Trade Mark of Calgon, Inc. for its glassy phosphate (sodium hexametaphosphate) products.

†Fully licensed for use under U. S. patents 2,337,856 and 2,304,850.

CALGON, Inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PA.

AWWA CONVENTION

St. Louis—May 6-11

Hagan-Calgon Exhibit—Booths 10-11-12

Be sure to stop at the Hagan-Calgon Exhibit. Inspect the equipment and talk over water management problems with Hagan and Calgon Engineers.

Now's the time to mail this month's Readers' Service card.

"Here's why our city installed its sixth BJ Submersible"

Says L. E. Cunningham, Mayor of this progressive midwestern city

WELCOME TO BELVIDERE ILLINOIS

CITY OF INDUSTRIAL ADVANTAGES

Facts about Belvidere, Illinois

A friendly city of 10,000, Belvidere is located *75 miles northwest of Chicago. Its industrial* advantages include abundance of water, skilled labor pool, good plant sites, low tax and utility rates, and excellent educational and recreational facilities. It is served by the Chicago and Northwestern Railroad and 26 major truck lines.

Facts about the BJ Submersible

The BJ Submersible operates completely submerged in water at any depth. This sealed, submerged unit needs no pump house and is unaffected by weather extremes, floods or dust. The BJ Submersible requires no field adjustments. Normally gives more than 20 thousand pumping hours before service is required. Silent and vibrationless.

"A dependable, protected water supply system is vital to the future growth of both our residential and industrial areas.

In the past our wells were pumped by surface motor deepwell turbines requiring pump house protection and special maintenance. In 1951 Wayne Richardson, our Waterworks Superintendent, working with R. Anderson, Engineering, replaced an old deepwell turbine with a modern Byron Jackson Submersible.

Our experience with this completely submerged pump was so satisfactory that we converted all our *wells to submersible operation, having just completed* the installation of the sixth unit. The combined capacity of all these units is now 5 MGD with storage facilities for 1,700,000 gallons.

The people of Belvidere are now assured a pure water supply that is completely safe from flood or other disaster conditions. And our people also benefit as taxpayers since routine maintenance is eliminated and no costly, space-consuming surface structures are necessary. Byron Jackson Submersibles have provided us with the answer to all our pumping problems."

SINCE **BJ** 1872

Byron Jackson

Division of Borg-Warner Corporation

P. O. BOX 2017A, TERMINAL ANNEX • LOS ANGELES 54, CALIFORNIA

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

The most important date for the Construction Industry in 1957

International
Amphitheatre
Chicago

A.R.B.A.
ROAD SHOW and CONVENTION
PLAN NOW!

1957 will bring with it the first Road Show in almost 10 years! Tremendous advancements have been made in this last decade. New equipment has been developed. New methods have superseded old. New cost-cutting ideas have come forward. Here is the time and place to bring yourself up to date on all the new developments.

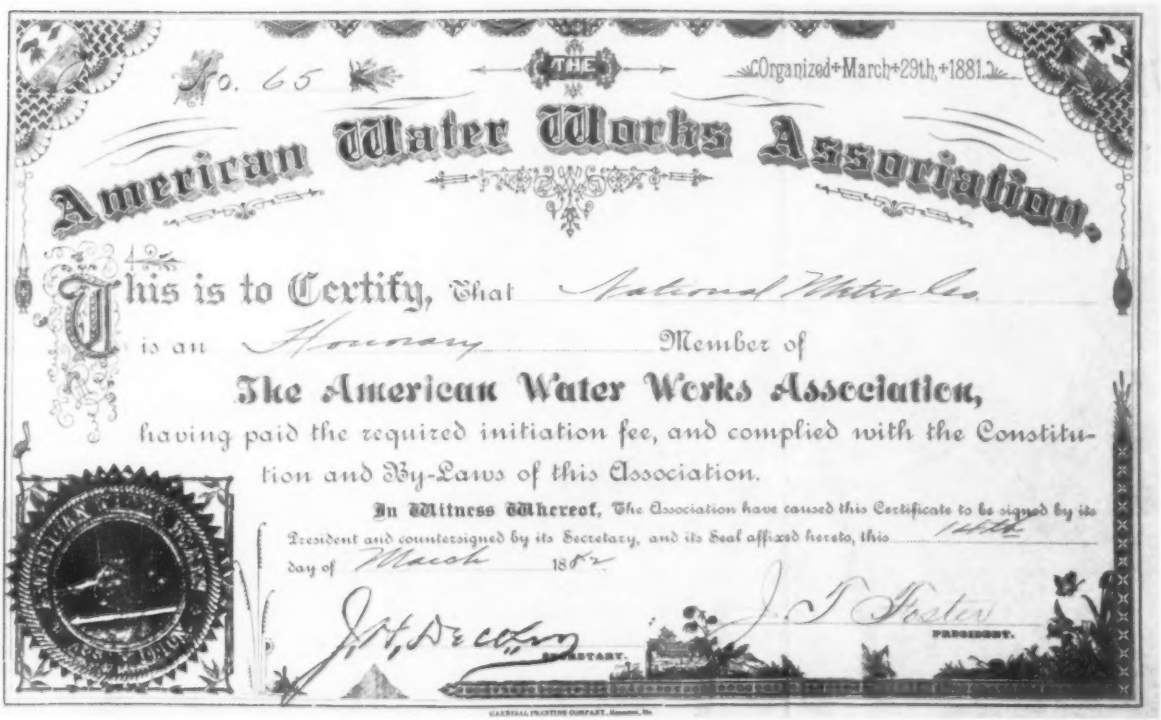
Nothing is being spared to make this 1957 Road Show the greatest indoor exhibit of machinery and materials ever gathered together. At the same time, the A.R.B.A. convention will give you an opportunity to learn about new methods and practices and hear outstanding authorities discuss the solution of problems that are bothering you.

Put it down as the most important date for the construction industry in 1957. Write for data on reservations. Ask to be put on the list to receive future information on the 1957 A.R.B.A. Road Show and Convention.

AMERICAN
ROAD BUILDERS'
ASSOCIATION
World Center Building
Washington 6, D.C.

We've Worked and Grown Together

. . . and mighty proud to serve a great industry



No. 65 THE Organized March 29th, 1881.

American Water Works Association.

This is to Certify, That National Meter Co.

is an Honorary Member of

The American Water Works Association,

having paid the required initiation fee, and complied with the Constitution and By-Laws of this Association.

In Witness Whereof, The Association have caused this Certificate to be signed by its President and countersigned by its Secretary, and its Seal affixed hereto, this 14th day of March 1882

J. T. Foster PRESIDENT.

SECRETARY.

Replica of membership certificate awarded the National Meter Division of Rockwell away back in 1882. Pittsburgh Meter, another Rockwell company, joined the A.W.W.A. in 1898.

Rockwell people have always been closely identified with the A.W.W.A. since the first year of its inception. From long association we have learned there is no group more dedicated to public service than the A.W.W.A. membership. It is to their credit that the water and sewage disposal systems of this country have grown to become immensely valuable properties—vital to the needs of every community.

We at Rockwell salute the A.W.W.A. on this, the 75th anniversary of the Association and pledge our continued support and close cooperation.

W. F. ROCKWELL, JR., *President* *(center) says, "We consider it our obligation to keep the development of our products and the improvement of our services ahead of the day-to-day needs of the water utilities."*

L. A. DIXON, JR., Vice President, Meter and Valve Division (left) and J. F. O'GRADY, Water Products Manager, concur.

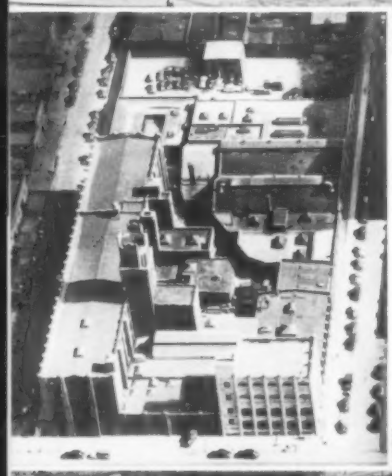
Rockwell Manufacturing Company

PITTSBURGH 8, PA.

dedicated to better service for you

Rockwell Increases Production • Intensifies

UNIONTOWN, PA. PLANT



BROOKLYN, N.Y. PLANT

PITTSBURGH, PA. PLANT

. . . better service for you

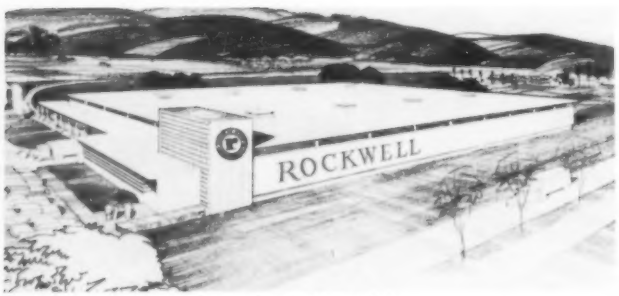
Rockwell water meters are now being made in three big plants located at Brooklyn, N.Y., Uniontown, Pa. and Pittsburgh, Pa. Service to West Coast water utilities will soon be materially benefited by the output from a large new factory now being erected in Porterville, California. And in Russellville, Ky., fabrication of raw materials has just started.

In the realm of research, extensive new Rockwell laboratories were recently opened. These are manned by a topnotch team of scientists. Rockwell facilities for product development are the finest—its staff by far the largest in the industry.

Personal service to customers has also been greatly enlarged. Nearly 200 trained and experienced men now represent Rockwell working out of 18 District Offices.

To the water works industry, all this means greater productive capacity, more new and improved products plus better service to those who buy and use Rockwell water meters.

NEW ROCKWELL PLANTS TO BE OPENED IN 1956



PORTERVILLE, CALIF.

RUSSELLVILLE, KY.

Research • Enlarges Sales Staff

P. C. KREUCH, ***Rockwell Vice President,*** says, "You can look to our staff of qualified territorial managers, and our large well-trained field force for real service to the industry."

Men Who Know Their Business

J. G. HOYT
Atlanta Dist. Mgr.

G. A. CUNNINGHAM
Charlotte Dist. Mgr.

F. C. ARENS
Boston Dist. Mgr.

R. A. JOHNSON
New York Dist. Mgr.

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PLUS A FIELD FORCE OF NEARLY 200 TRAINED AND EXPERIENCED MEN TO SERVE YOU

. . . See important announcement, next page.

G. T. BOWMAN, *Products Manager, tells why*

The New Rockwell

Parts Packaging Program

. . . Means Better Service For You

▲ Shipping room at a Rockwell parts depot.

▲ Measuring chambers individually packaged.

▼ Packaged parts stack neatly, save space.

Save Time—Space—Money

Most parts for Rockwell meters are now being neatly packaged in convenient quantities. Each package is clearly labeled. Complete parts for many sub-assemblies can also be obtained pre-sorted into easy-to-use packets.

These compact, carefully designed packages prevent damage in shipment or deterioration in storage. They stack neatly on shelves—eliminate the need for bulky bins—simplify inventory control and re-ordering.

This packaging program saves you time, space and money. It's just another way Rockwell offers better service and better value to water utilities.

ROCKWELL

Rockwell Manufacturing Company

PITTSBURGH 8, PA. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa In Canada: Rockwell Manufacturing Company of Canada, Ltd., Toronto, Ontario

Litho in U.S.A.

Parlon® Stays On

Protects Municipal Swimming Pools

PARLON ON CONCRETE—Since the City of Omaha opened this municipal pool in 1950 it has been kept looking its Sunday Best all season long by RAMUC, a Parlon-based protective coating manufactured by Inertol Co., Inc., Newark, N. J. Omaha's general foreman of maintenance credits this finish with keeping this concrete pool attractive while holding down maintenance and operating costs.

Whether the pool is steel or concrete, municipal maintenance departments heads throughout the nation have found that they can depend on a Parlon-based finish for longer-lasting beauty at lower long-term cost.

Already familiar with the unique chemical and corrosive resistance qualities of Parlon-based coatings for many other municipal uses, these men have found that special Parlon formulations provide the colorful finish they want for pools combined with under-water wearing properties that mean less maintenance cost.

Wherever protective coatings must meet a challenge, whether it be interior or exterior, masonry, wood or metal, look to Parlon for the ideal all-purpose maintenance paint. Your local paint supplier can provide additional information, or write direct to Hercules.

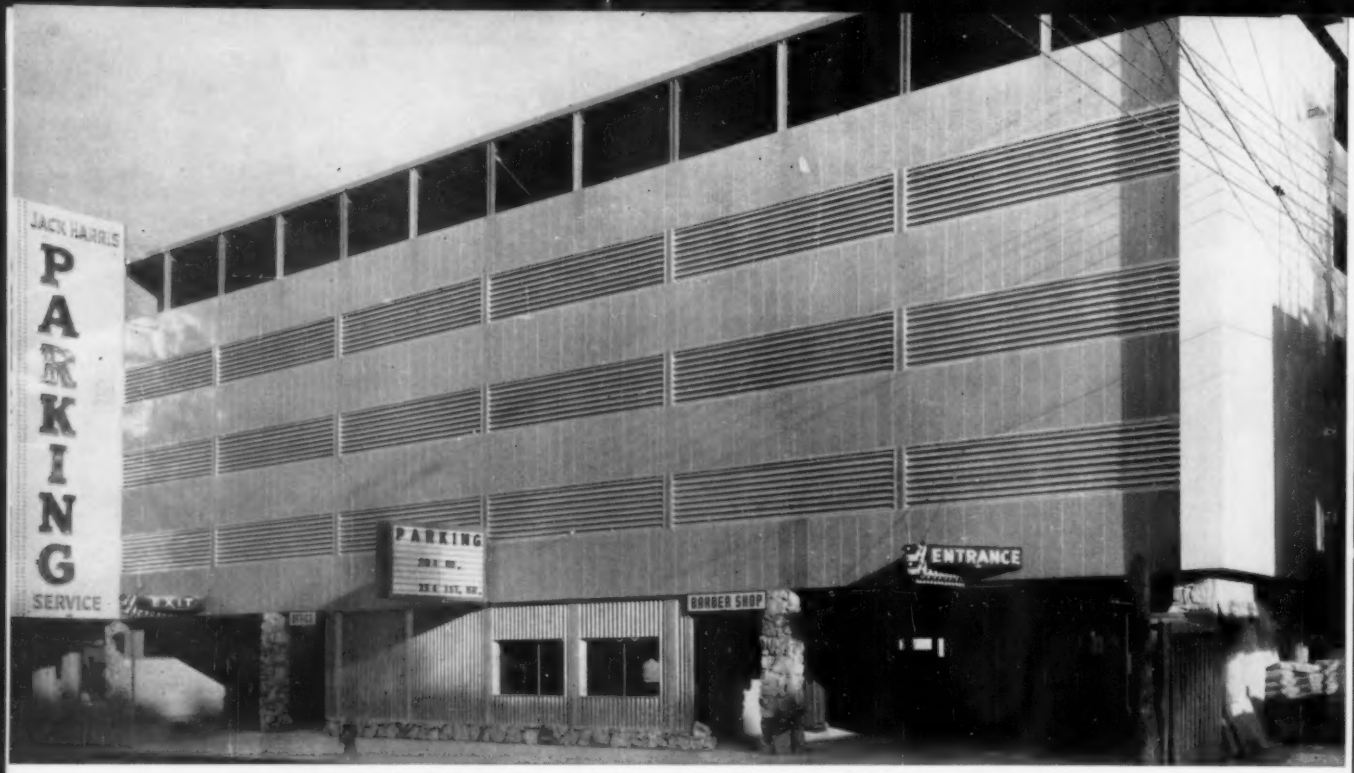
PARLON ON STEEL—This steel pool, too, is painted with RAMUC. Its tile-like finish has withstood the attack of water and water-treatment chemicals without peeling or powdering.

Cellulose Products Department
HERCULES POWDER COMPANY
INCORPORATED
978 King Street, Wilmington 99, Del.

CR56-5

PARLON CHLORINATED RUBBER PAINTS ARE AVAILABLE FROM 400 MANUFACTURERS UNDER THEIR OWN BRAND NAMES

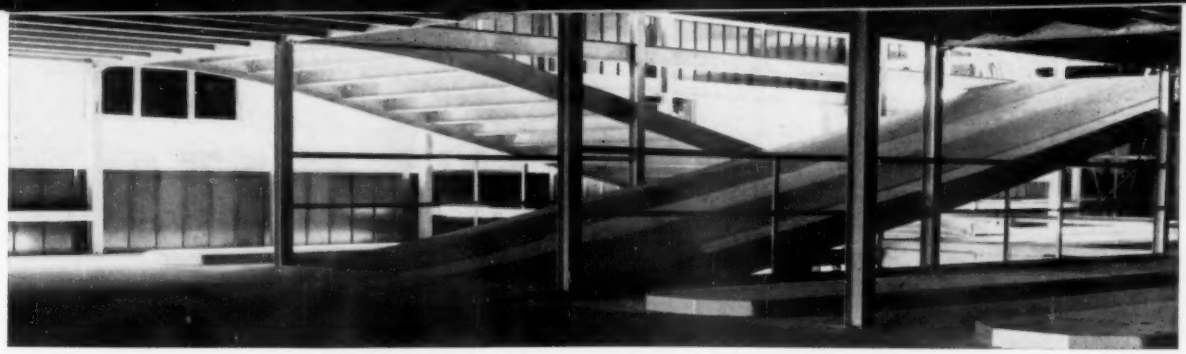
Need more facts about advertised products? Mail your Readers' Service card now.



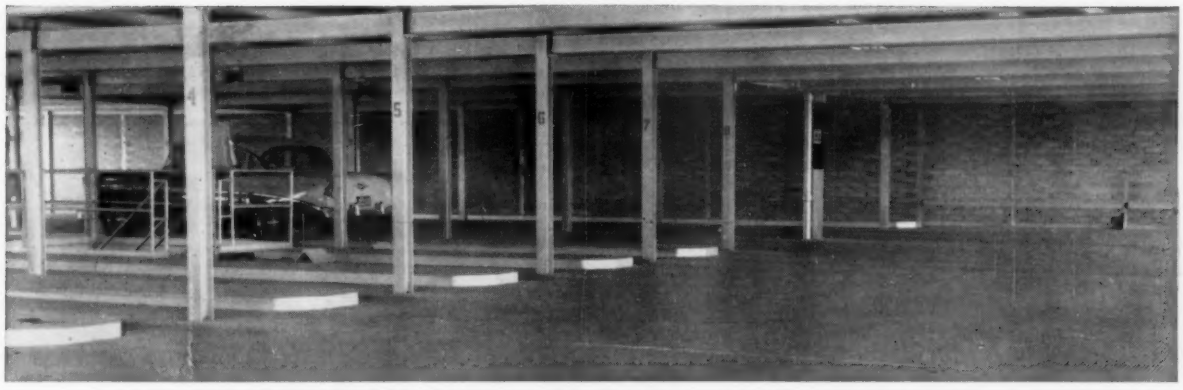
THE JACK HARRIS PARKING SERVICE. *Architect:* Walter Zick and Harris Sharp, Las Vegas, Nevada. *Consulting Engineer — Contractor:* Ellis E. White Company, Engineering-Contracting, Park-on Structures, Beverly Hills, Cal.

How Jack Harris *saved*

STRUCTURAL FRAMEWORK DURING ERECTION. The modular constructed building consists of five basic parts: steel columns, floor beams, parking panels, walkway panels, and aisle panels. Can be rearranged to fit almost any size rectangular or square lot.



INTERIOR. Ramps are surfaced with expanded steel grids for better traction.



PARKING AREA—FIFTH FLOOR. Flooring is prefabricated. Formed steel floor panels are joined to Structural Steel channel and I-beam floor supports, and are covered with USS Multigrip Floor Plate.

money in Las Vegas

This is the Jack Harris Parking Service, a five-floor, 300-car parking structure, located in the golden heart of Las Vegas.

The building rests on concrete slab and reinforced concrete footings. But the structural framework, the ramps, the upper four floors, the roof and most of the siding are of STEEL. And that's where Jack Harris saved his money!

Over 500 tons of USS Structural Steel were used in the framing of this building, along with approximately 180 tons of USS Multigrip Floor Plate.

MAN HOURS SAVED? Hundreds of them! Plus the fact that Structural Steel is the *most economical* of load-bearing materials.

VERSATILITY? By all means! Structural Steel can be bolted, riveted or welded, and can be erected in *any weather* in which men can work.

DEPENDABILITY? No doubt about it! Structural Steel is the *strongest* of load-bearing materials—will withstand more abuse than other structural materials, effectively resisting tension, torsion, compression and shear.

MAINTENANCE? Never! Once enclosed in buildings, Structural Steel lasts indefinitely, requiring no maintenance.

QUALITY? Unquestionable! Steel members are fabricated indoors; therefore, weather can have no effect on the quality of the workmanship.

You can save construction dollars, too. Whether your municipal project be parking garages, schools, government buildings, or even airports —you won't find a stronger, safer, more practical construction material than Structural Steel.

USS STRUCTURAL STEEL

SEND FOR THIS FREE BOOK NOW

UNITED STATES STEEL CORPORATION, PITTSBURGH
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FREE EQUIPMENT DATA to Help Your PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

New Heavy Duty Utility Digger

113. A utility digger that will dig approximately 600 post holes a day from your tractor seat is fully described in literature from B-M-B Co., Inc., 319-21 New York Ave., Holton, Kansas. Available for Case, Allis-Chalmers, John Deere, Ford and Ferguson tractors, this auger comes in a standard size of 9 ins. x 36 ins. with optional sizes available. For full data check the reply card.

The Indoor-Outdoor Crane of Many Uses

226. Literature has just been released on the new Austin-Western hydraulic crane that has many uses either indoors or outdoors and is available from Austin-Western, Baldwin-Lima-Hamilton Corp., Aurora, Ill. Dimensions, performance data, attachments, special equipment and specifications are fully covered. Check the reply card.

What You Should Know About Buying A Motor Grader

279. A detailed explanation on the performance of a motor grader is included in the booklet entitled "When You Buy a Motor Grader", available from Caterpillar Tractor Co., Peoria, Ill. Other features in this excellent guidebook for choosing a motor grader are operator convenience and operating costs. Check the reply card.

Continuous Concrete Bridges

416. A 106-page catalog published by the Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill., is a working text giving a complete procedure for design of continuous bridges, from layout to final analysis. Applicable for highway or railroad loading, the catalog includes a procedure for determination of deflections and curves to reduce the labor of computing deflections of multiple-span structures. Check the reply card today.

Technical Supplement Describes Mixing, Coagulation and Flocculation

469. A new Technical Supplement issued by American Well Works, Aurora, Ill., provides full engineering data on slow mix equipment for chemical mixing, coagulation and flocculation. Design details, specifications and useful general data are included. Check the reply card for your copy.

Catalogs on Street Sweepers and Flushers, Bituminous Distributors and Maintenance Units

470. Catalogs which feature photos and detailed specifications of street sweepers, flushers, bituminous distributors, gravity sprinklers and maintenance units have just been released by the Municipal Supply Co., 2508 South Main Street, South Bend 23, Indiana. Standard and optional equipment are listed for each piece of machinery. Get your catalogs by checking the reply card.

Information on Portable Concrete Testing Machines

471. A new bulletin on portable concrete testing machines, flexure attachments and accessories has just been released by Soiltest, Inc., 4711 West North Avenue, Chicago, Ill. Apparatus for preparation of concrete specimens for strength testing and for slump, yield and air entrainment testing and detailed illustrations of products and applications, technical descriptions and size and weight specifications are also shown. Check the reply card for your copy of Bulletin CT-711.

Catalog on Floodlighting and Area Lighting Poles

194. Complete information on floodlighting poles for athletic fields, parking lots and shopping centers is fully described in catalog from The Union Metal Mfg. Co., Canton 5, Ohio. Mounting arrangements, aluminum and steel monotube poles, hinged floodlighting poles and pump island poles are a few of the items covered. Check the reply card.

Bulletin on Submersible Booster Pump

201. Typical installations, description of unit, standard models, selection tables and the many jobs where this pump can be used are fully described in the bulletin. For full details write Layne & Bowler Pump Co., 2943 Vail Ave., Los Angeles 22, Calif., or check the handy reply card today.

Complete Line of Concrete Gunning Equipment

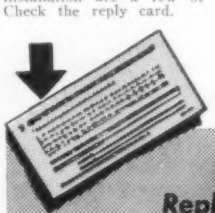
208. A 16-page catalog that gives complete details, specifications and operating capacities of concrete gunning equipment and answers to many of the questions asked about air placed or gunned concrete is available from Air Placement Equipment Co., 1009-11 West 24th Street, Kansas City 8, Mo. Also included are several pages of actual job application photographs showing the many and varied uses of this modern equipment. Check the handy reply card for your copy of this catalog.

Locating Underground Pipes

253. Complete information on pipe locators and leak detectors is available in literature from Goldak, 1544 West Glenoaks Blvd., Glendale 1, Calif. The operation of the units and how they are used in the field are fully described. Check the handy reply card.

Valuable Information on Underground Pumping Stations

246. The complete prefabricated underground pumping station is fully described in a bulletin just released by Zimmer & Francescon, 1715 Fifteenth Street Place, Moline, Ill. Construction features, corrosion control, electric controls, specifications, pumping equipment and installation are a few of the items covered. Check the reply card.



Use the Reply Cards Inside Front Cover

Helpful Information on Copper Tube and Pipe

338. A 12-page catalog with helpful information about copper tube and pipe is offered by Lewin-Mathes Co., St. Louis 2, Mo. A chart in the front of the catalog lists ten kinds of tube and pipe manufactured, their specifications, the tempers and lengths in which each is available and typical uses along with general data and comparative tables. Check the reply card today.

Heavy-Duty 3-Axle Tandem Roller

339. Complete specifications on the 13-20 ton Buffalo-Springfield 3-axle Walking-Beam tandem roller are covered in a 12-page Bulletin S-71-1255. The Walking-Beam consists of a beam from which are suspended an end guide roll and center guide roll and the beam is center-pivoted to move in a vertical arc. For complete details write Buffalo-Springfield Co., Springfield, Ohio, or check the reply card.

Conversion Unit For Power Steering on Motor Graders

354. You can have power steering on your present motor graders by use of a Behlen Powr-Steer. Fits Cat, Adams, Allis-Chalmers tractors, and with minor modifications can be adapted to fit other models. For full information write Behlen Mfg. Co., Columbus, Nebr., or check the reply card.

New Acker Vane Shear Tester

367. A bulletin describing a new inexpensive accurate technique for obtaining "in-place" shear readings of soils is available from Acker Drill Co., Inc., Scranton 3, Pa. The shear test kit has a complete set of vane test tools for testing soils to depths of 100 ft., and operating information on this kit is covered in Bulletin 700, available by checking the reply card.

Electric Eel Sewer and Drain Cleaning Machines

384. A new electric eel that is non helixing has a self feeding cable, snap lock, cable connectors, no handling of rotating cable and the motor does all the work, is fully described in bulletin available from The Ohio Tool and Engineering Co., 128 N. Spring St., Springfield, Ohio. For information on tools for this dual cable eel and on the power unit and other valuable data, check the reply card.

Simple Culvert End Finishes With CMP

393. A new illustrated bulletin from Armco Drainage & Metal Products, Inc., Middletown, Ohio, tells how to achieve a wide variety of end finishes with corrugated metal pipe installations. Among these are end sections, square, beveled and skewed ends, riprap, sheeting and drop inlet. Check the reply card today for your copy.

A Precast Concrete Filter Bottom

394. The Criscrete unit is precast prestressed concrete built monolithically spanning the entire width of the filter in one piece. It requires 6 in. overall depth in the filter and employs non ferrous nozzle liners. For complete information on this filter unit get literature available from MCG Co., 1771 W. 5th Ave., Columbus 12, Ohio, by checking the reply card.

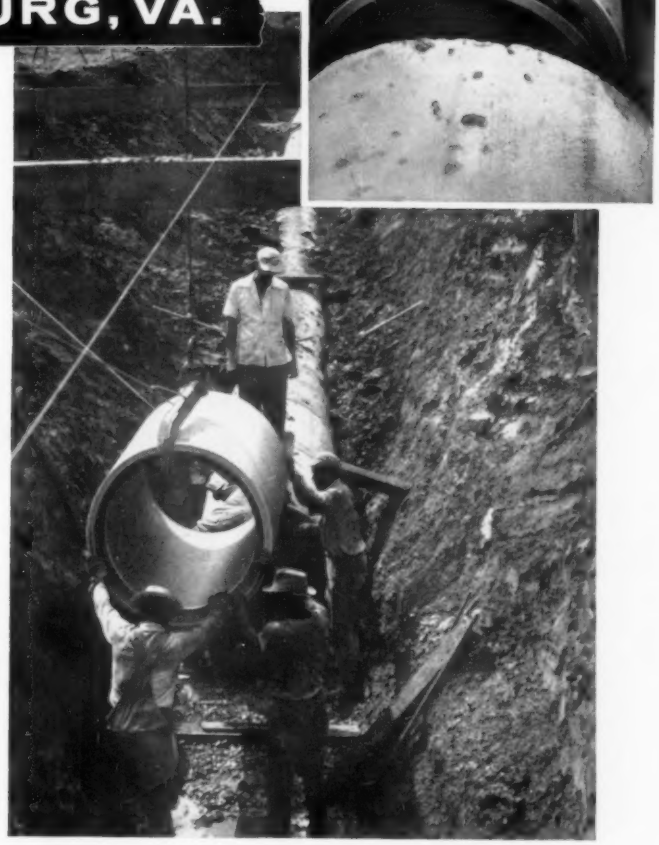
FREDERICKSBURG, VA.*

chooses

TYLOX RUBBER PIPE JOINTS

to

- ***STOP INFILTRATION***
- ***PREVENT JOINT FAILURES***
- ***SPEED PIPE-LAYING***



For its new sewage treatment plant, the city wanted long-lasting, low-maintenance lines—built within the budget. Engineers wanted leakproof lines that would *stay* leakproof. Contractors wanted fast pipe-jointing to offset construction problems posed by wet soil conditions . . .
Here's how the choice of TYLOX Rubber Joints helped meet all these requirements efficiently and economically:

TYLOX Joints seal water-tight by compression, and natural resilience of the rubber *keeps* the seal tight. Tylox resists sewerage and industrial waste corrosives . . . its specially compounded rubber never deteriorates. TYLOX speeds pipe-laying through fast assembly, and by eliminating delays . . . wet trenches can't slow up the work, and laid line can be backfilled immediately.

WRITE TODAY for more details and illustrated performance histories on TYLOX Joints. Assure fast-working, leakproof and non-deteriorating joints for *your* pipe jobs by specifying TYLOX RUBBER JOINTS.

5025

* **PROJECT:** Sewage Treatment Plant, City of Fredericksburg, Va.

ENGINEERS: Freeman Funk, City Engineer, and Whitman, Requardt & Associates, Consulting Engineers

CONTRACTORS: Abbot and Ritchie, General Contractors, W. C. Spratt, Pipe Contractor, Fredericksburg, Va.

PIPE: TYLOX-Jointed Reinforced Concrete, furnished by Concrete Pipe & Products Co., Inc., Richmond, Va.

HAMILTON KENT MANUFACTURING COMPANY
KENT, OHIO
427 West Grant St. Orchard 3-9555

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NEW LISTINGS (Cont.)

Literature on Steel Bridge Flooring

114. Design specifications and construction layout of steel bridge flooring are fully covered in literature available from Bethlehem Steel Co., Bethlehem, Pa. This steel flooring stiffens weakened structures, provides a simple, maintenance-reducing flooring for bridges and overpasses and replaces worn plank flooring on older bridges. For full information check the handy reply card.

Information on Street and Highway Signs

149. Street and highway signs that are porcelain enamel embossed are fully described in literature available from Ferro Enameling Co., 1100-57th Ave., Oakland 21, Calif. Stop, speed limit, regulatory, parking, pedestrian, warning, street name and guide signs are a few of the signs mentioned. Check the handy reply card.

A Street Sweeper For Every Sweeping Need

158. A new catalog containing eight pages of illustrated information on street sweeping with the Mobil Sweeper, motor pickup type street sweeper, is just off the press. It is used on streets, highways, airports, parks, parking areas and other paved areas. For your copy write Mobil Sweeper Div. of the Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif., or check the reply card.

New Manual on Electric Plants

218. An 8-page manual entitled "Engineered Kilowatts" describing the new concept in the field of electric plants, kilowatt-producing machines, is available from International Fermont Machinery Co., Inc., Ramapo, N. Y. Included are discussions on selection factors, typical specification and a list of data covering such items as installation and automatic starting controls. Check the reply card.

Refibering Rotary Sweeper Brooms

231. A smooth, automatic, one-man operation for refibering rotary sweeper broom cores is now possible with the Cor-A-Matic machine, which can refiber a five-foot broom in 12 minutes. For full details on several models write Municipal Research & Development Corp., 1331 Third Ave., Seattle 1, Wash., or check reply card.

How and Where to Install A Septic Tank System

270. A manual on modern sewage disposal methods for individual dwellings, camps and rural schools has just been released by Brown Co., 150 Causeway St., Boston, Mass. Location, size of and building the tank, how large a disposal field and laying out the field are discussed. Check the reply card today.

How to Eliminate Seepage On Construction Projects

472. Labryinth waterstops are easily installed to provide the answer to the seepage problem and simplify form work on all types of construction jobs. Investigate their use for water and sewage plants, reservoirs, swimming pools, etc. For full data check the coupon or write to Water Seals, Inc., 9 So. Clinton St., Chicago 6, Ill.

Sensitive Photoelectric Colorimeter for Water Tests

290. The Lumetron Model 450 photoelectric colorimeter uses Nessler tubes for sample holders; is designed mainly for water analysis and other tests requiring the measurements of faint colorations and turbidities. Literature available from Photovolt Corp., 95 Madison Ave., New York, N. Y. Check the reply card.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100-page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 148 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill., by checking the coupon.

Complete Data on Water Valves

262. Complete description and detailed cross section and cutaway views describing construction and operation of a complete line of valves are covered in Bulletin 561 just released by Kennedy Valve Mfg. Co., East Water St., Elmira, N. Y. Detailed information on the O-Ring construction, and lists in detail a complete range of sizes with dimensions in tabular form are also included. Check the reply card today.

Cut Trenching Costs With the Everett Trencher

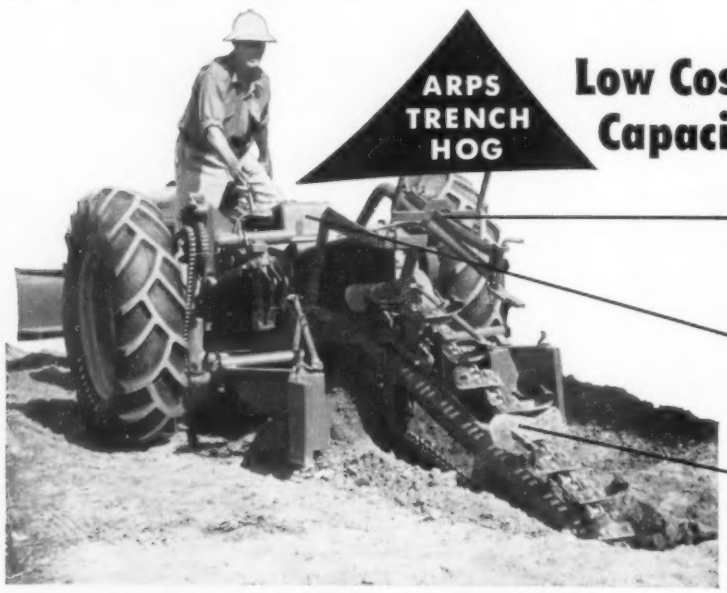
264. A newly issued two-color bulletin describing the Model 60 Everett trencher, a multi-feature digger, that is used with Ford, Ferguson and Massey-Harris M-H 50 tractors, has just been released by the Earth Equipment Corp., 2036 Sacramento St., Los Angeles 21, Calif. It digs trenches down to five feet in depth and can attain 300 lineal feet an hour. For more information check the handy reply card.

Portable Generator Plants

285. A new four-page bulletin which includes a check list to show how to choose the correct portable power plant for every job has just been released by Master Vibrator Co., 265 Stanley Ave., Dayton, Ohio. Also included are specifications and a chart which gives the amount of wattage needed to run various types of power tools. For complete information check the reply card.

Single Pneumatic Ejector Sewage Lift Station

322. The "Mon-O-Ject factory-built single pneumatic ejector sewage lift station for small subdivisions, factories and schools is described fully in Bulletin 1615 just released by Smith & Loveless, Inc., P.O. Box 8172, Kansas City, Mo. How it works, typical specifications for engineers and architects and the advantages of the station are a few of the discussions. Check the handy reply card for your copy.



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GULF SANI-SOIL-SET is the practical answer to your dust annoyance problems. Here are a few of the many good reasons why it will pay you to investigate this efficient dust-control medium now:

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Gar Wood Pipe and Utility Ditcher

421. Literature is available on the Gar Wood-Buckeye 305 crawler trencher from the Customer Service Dept., Gar Wood Industries, Inc., Wayne, Mich. Line hydraulic wheel hoist and hydraulic conveyor drive are several features of the ditcher described in the bulletins. Check the reply card.

Fast Marker for Traffic Guide Lines

474. Free-floating, adjustable paint shields on the Mark-Rite Econo-Liner follow surface contours and produce sharp lines in any width from 2" to 6". This machine is said to paint 10,000 to 15,000 feet of line per hour. For details get Form E-100 from Unimasco, Inc., 5211 Pacific Blvd., Huntington Park, Calif.

Filtros For Water Filtration

475. Modern porous plate underdrain systems of Filtros silica and fused alumina offer new efficiency in water filtration. Some advantages are complete back washing, prevents formation of mud balls, no metal parts to corrode and built for maximum efficiency and economy. For complete information write to Filtros Inc., 603 W. Commercial St., East Rochester, New York, or check the handy reply card.

Side Boxes For Pick-Up Trucks

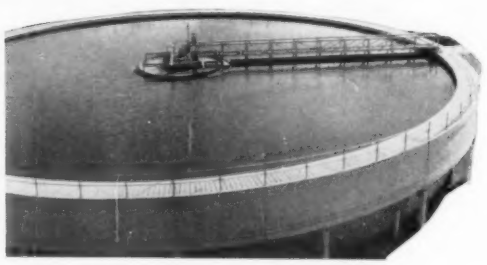
476. All-steel, welded side boxes that can be mounted on any make or model of pick-up truck, which converts your "pick-up" to a modern service truck are described in literature available from Stahl Metal Products, Inc., 3490 W. 140th St., Cleveland 11, Ohio. Check the reply card today.

Catalogs on Horizontal and Industrial Service Pumps

477. Pump capacities, heads and horsepowers are fully described in Catalogs B-505 and B-1300 available from Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Avenue 26, Los Angeles 31, Calif. For this information on how these horizontal and industrial service pumps can help, you check the reply card.

PRELOAD experience

for **ALL** your tanks



The clarifier tank (above) is but one of many types of prestressed concrete construction offered by PRELOAD. Over 1,000 tanks built are included in our record.

PRELOAD'S years of experience, plus its new policy of centralized engineering and licensing of qualified local contractors, covers the whole range of successful tank construction.

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WATER WORKS

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes. Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A. Chicago 80, Ill. Check the reply card.

Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparling Meter Co., Box 3277, Los Angeles 54, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use reference. Requests for this valuable publication should be accompanied by your business letterhead.

Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American water meters described in Bulletin No. 55 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Get your copy by checking the reply card.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves. Check the reply card for this useful information.

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New model **HO**
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7,500 lbs. @ 4 mph

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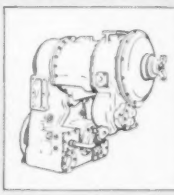

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66. Get latest data on Jones chlorine service for liquid chlorine, calcium hypochlorite and sodium hypochlorite packaged in lots best suited for your needs. Six strategic locations serve all parts of the country. Check the reply card or write John Wiley Jones Co., Caledonia, N. Y.

Bulletin on Remote Metering and Control

92. An 8-page color bulletin describing how chronoflow telemeters bring accurate records and control over an unlimited distance to the fingertips of plant operators is now available. Divided into 8 descriptive sections on various telemetering applications, the bulletin contains photos and installation drawings in addition to a description of the system's operation. Full details from Builders-Providence, Inc., Providence, R. I., or check the handy reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Complete Catalog on Pipe Line Equipment

121. Listed under one comprehensive catalog No. 26 are a complete line of water, gas and sewer pipe line equipment. Some of the items covered are pipe cutters, diaphragm pumps, melting furnaces, caulking tools, M-scope pipe finders and joint runners. Write to Joseph G. Pollard Co., Inc., New Hyde Park, N. Y., or circle the reply card for your copy.

Helpful Reference on Swimming Pool Equipment

87. A complete reference catalog of swimming pool supplies, chemicals and equipment is available from Modern Swimming Pool Co., Inc., 1 Holland Ave., Dept. PW, White Plains, N. Y. Detailed information covers filters and accessories, all types of fittings and equipment and helpful suggestions on chemical treatment and pool maintenance. Get your copy of this 44-page book by checking the reply card.

Specifications for Infiltration Galleries

157. Infiltration galleries, constructed by the Ranney method, are described in an attractive bulletin issued by Ranney Method Water Supplies, Inc., 841 Alton Ave., Columbus 19, Ohio. This bulletin, plus complete standard specifications for the construction of horizontal infiltration galleries, are available by checking the reply card.

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Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

Lay Water Mains Faster With "Fluid-Tite" Couplings

184. Get permanent water-tight joints automatically with Century "Fluid-Tite" couplings for Century asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keasbey Mattison Co., Ambler, Penna. or by checking the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the reply card.

What You Should Know About Fluoridation

217. A helpful publication entitled "Fluoridation" which describes the development of fluoridation and lists the chemicals and dosages normally used has been prepared by Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Copies of publications on both solution and dry feed W&T Fluoridators are also available. These publications are yours for checking the reply card.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. PW, 2413 W. Carlson St., Pittsburgh 4, Pa.

Catalog on Sewage Gas Meters, Regulators and Valves

245. A handy catalog on sewage gas meters, regulators and valves is available from Rockwell Mfg. Co., Pittsburgh 8, Pa., also included are data on lubricants and accessories, power and remote operation, semi-steel valves and multiport valves. Check the reply card.

How A Diatomite Filter Works

466. The three main steps in diatomite filter operation—precoating, filtering and cleaning are discussed and clearly illustrated with specially prepared drawings in Bulletin No. 5502 of the General Filter Co., Box 11, Ames, Iowa. Get this interesting bulletin by checking the reply card.

Money Saving News To All Rotary Broom Users . . .

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REFIBERS ROTARY SWEEPER CORES AUTOMATICALLY IN ONLY . . . 12 MINUTES

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COR-A-MATIC HD14

will transform your broom refibering operation from one that is tedius and costly to a smooth, automatic, one-man operation that is fast, simple and inexpensive.

COR-A-MATIC HD14

saves over 75% in labor cost alone and produces a better, longer lasting broom with superior sweeping qualities. Voids and unbalance are eliminated because a *solid continuous mat* of fiber travels up the feed belts to the automatic bending mechanism.

NOTE — We will be in production soon on the COR-A-MAKER, our new speed attachment for making new wood cores on the COR-A-MATIC model HD14 at a mere fraction of present costs.

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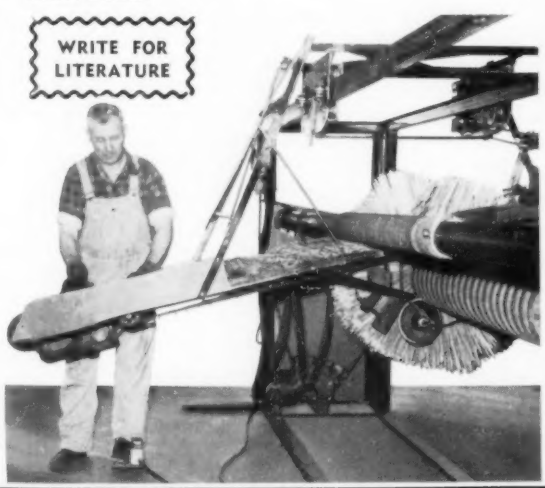

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- **Clean Tunnels . . . Walls . . . Building Exteriors . . . Statuary**
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- **Clean Bar Screens . . . Chambers . . . Sewers and Trucks in Sewage Treatment Plants**

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Manual Covers All Types Of Pipe and Service Repairs

266. Full details on the entire line of Skinner-Seal pipe repair clamps, service fittings and drilling equipment are presented in a new catalog and service manual offered by the M. B. Skinner Co., South Bend, Ind. Step-by-step installation pictures and captions give clear, concise instructions for the repair of all types of pipe leaks. Get helpful Catalog GW by checking the reply card.

Reference Book on Lubricated Plug Valves

273. Lubricated plug valves, including stick-proof lever sealed valves for easy operation and positive mechanical seal are fully described in reference books issued by Homestead Valve Mfg. Co., Box 550, Coraopolis, Pa. Check the reply card for your copy.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the reply card.

Pitot Water Leak Detector

301. A comphrehensive and well written 20-page bulletin, No. 1301, of interest to engineers and maintenance personnel of municipalities, public works and water works dealing with water conservation and water wastage, is available from Simplex Valve & Meter Co., Lancaster, Pa. For this valuable data on care of equipment and installation instructions check the handy reply card.

Valuable Information On Prestressed Concrete Tanks

356. This helpful booklet describes the design, uses and advantages of prestressed concrete in all types of storage tanks. Plenty of charts, diagrams and illustrations are included. Get yours from Preload Enterprises, Inc., 211 East 37th St., New York 16, N. Y., or check the reply card.

Case Histories on Water Meter Installations

283. A factual report of the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters is available from the Ford Meter Box Company, Inc., Wabash, Ind. Monthly meter rates, inspection report cards and various types of pack joint horns and setters are fully described. Check the reply card for your copy.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the reply card.

All About Centrifugal Pumps

361. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals Use reply card or write to Fairbanks, Morse & Co., Dept. P. W., Chicago 5, Ill.

Here's Help for Laboratory Planning

369. A comprehensive laboratory planning guide that tells the engineer and designer how to obtain maximum space economy; utilize new and present facilities; and use functional design in locating utilities, ventilation and lighting is now available from Metalab Equipment Corp., Hicksville, L. I., N. Y. Complete data includes sectional and interchangeable lab equipment, furniture and accessories. Check the reply card for this valuable planning aid.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Reference Data on the Electric Check Valve

344. Comprehensive data on the Double Cushioned Electric Check Valve which simplifies backflow control at pumping installations is contained in an 8-page technical bulletin, issued by Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Details on valve design for quiet, positive operation, dimensions, wiring arrangements and head loss are included. Check the reply card for Bulletin W-10.

How to Clean and Develop Water Wells

375. The use of Weltone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa. or check the reply card.

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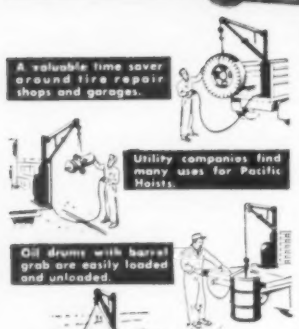
Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check reply card for your copy.

Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Hoist


A valuable time saver around tire repair shops and garages.
Utility companies find many uses for Pacific Hoists.
Oil drums with barrel grab are easily loaded and unloaded.
Bottle grab is used in loading and unloading of carbonic tanks.

Pacific Portable Hoists cut receiving and delivery costs...pays for itself in a few months... consumes a minimum of current from regular truck battery. Low in price. Interchangeable from truck to dolly in moments.

Write factory for illustrated literature and name of local dealer.

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HOIST DIVISION: 2944 S. E. Powell · Portland 2, Oregon

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Booths 36 and 37

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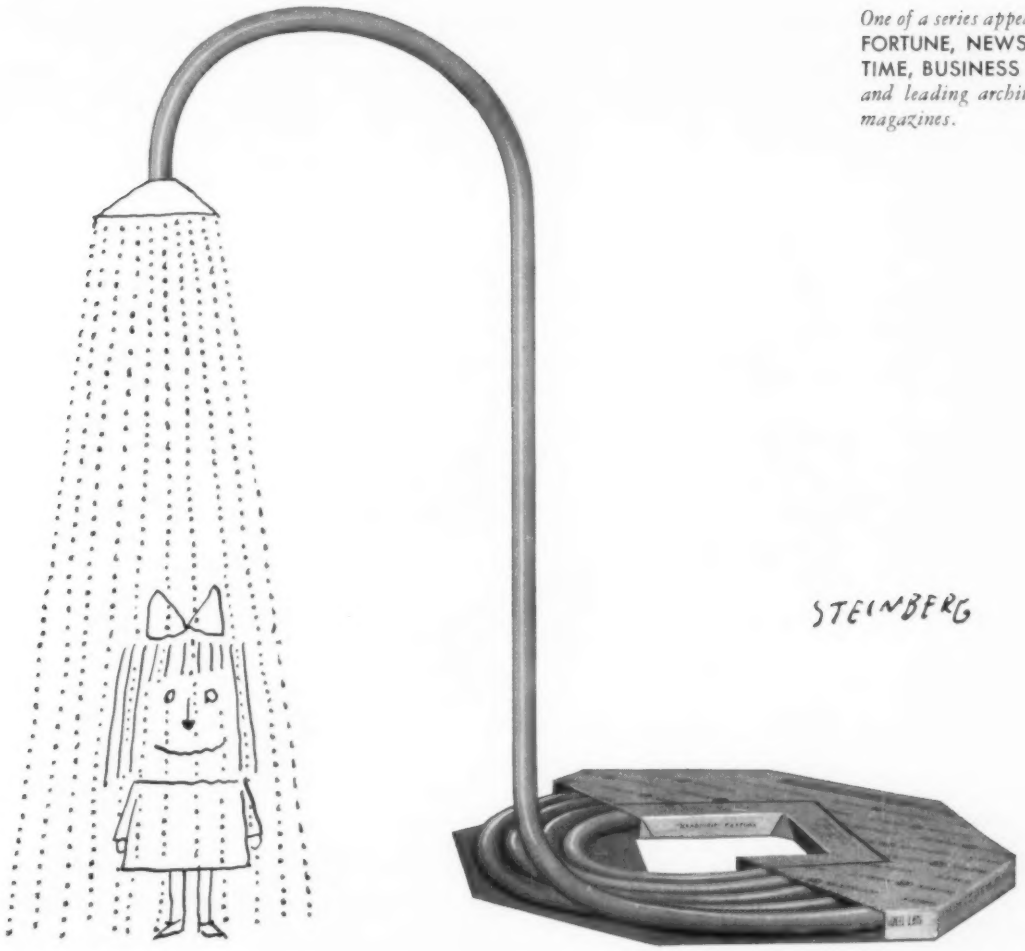
*Reg. U. S. Patent Office

One of a series appearing in FORTUNE, NEWSWEEK, TIME, BUSINESS WEEK *and leading architectural magazines.*



How to keep the Fountain of Youth from Aging...

fastidious

Lewin-Mathes Seamless Copper Tube and Pipe showers its benefits in a pure, steady stream on a little girl. And decades later, it will show equal regard for her grandchild.

Through the years, the Lewin-Mathes installation performs like new without maintenance because—as Copper Tube *Specialists*—we build Copper's resistance to everything except flow. Lewin-Mathes' fastidious-minded inspectors — at every operation throughout our *completely integrated plant*—demand shiny smooth surfaces *inside* as well as outside our products.

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Engineering Data on Equipment for Municipal Water Conditioning

347. For information on the design and operation of many types of water treatment plant equipment, including the Graver Reactivator, pressure filters, iron removal installations, zeolite softening and water conditioning for swimming pools get Bulletin WC-113 from Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. Check the reply card.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long. Check the reply card.

●

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Sewer Capacity Speedily Restored By "Reboring" Service

24. An attractive brochure offered by National Power Rodding Corp. describes their mobile unit with specially designed power rodding drive and central mechanism that gets on the job fast; rebores clogged sewers and drains cleanly and safely without impeding traffic or disturbing property. Check the reply card or write National Power Rodding Corp., 1000 So. Western Ave., Chicago 12, Ill.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP-31 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 30 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Comminutors for Automatic Disposal of Coarse Sewage Solids

152. The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Comminutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installation. Chicago Pump Co., Dept. J, 622 Diversey Pkwy., Chicago 14, Ill. Check reply card for your copy.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

Flexible Coupling Speeds Vitrified Pipe Installation

311. Fast pipe laying with chemically inert, leakproof joints is made easy by Universal vitrified pipe with Tylox rubber joints. Full information on these materials and pipe laying methods is available from Universal Sewer Pepe Corp., 1500 Union Commerce Bldg., Cleveland 14, Ohio. Check the reply card.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the reply card for your copy of this helpful handbook.

Valuable Bulletin on Rodney Hunt Sluice Gate

61. Sluice gate seats on a resilient rubber seal flush with the bottom of the channel and eliminates bottom wedges and the trough in which they descend. Gives design flexibility in water filtration, sewage treatment and sluices, dam, channel and chamber flow control. For complete details write to Rodney Hunt Machine Co., 82 Lake Street, Orange, Mass. for Bulletin 75, or check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet to made on business letterhead.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled, permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card for free copy.

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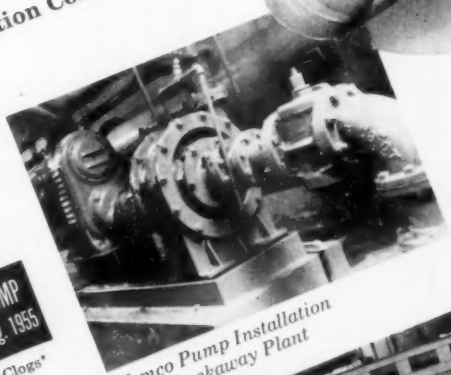
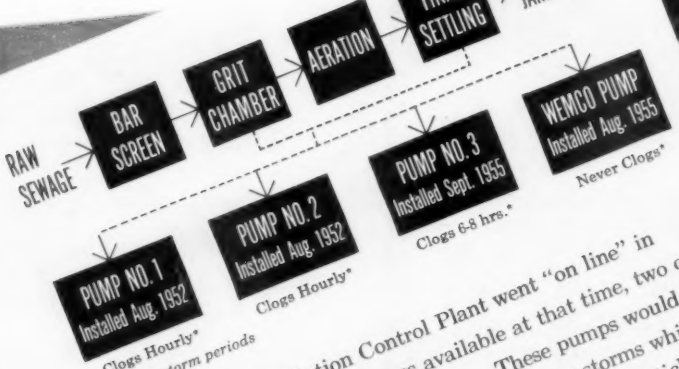
WEMCO *the sewage pump that never clogs* **PROVED IN COMPETITIVE SERVICE** *at Rockaway, New York*

Rockaway New York Pollution Control Plant



Wemco Pump Installation at the Rockaway Plant

Rockaway New York Pollution Control Plant



*During storm periods

The Rockaway Pollution Control Plant went "on line" in August 1952 using four pumps available at that time, two of which remain in the flow sheet above. These pumps would plug on an average of once every two hours during storms which washed in comparatively large amounts of rags and sticks. During August 1955 a WEMCO Torque Flow Solids Pump was installed as a replacement of one of the four original pumps. **The WEMCO Pump has never clogged** and has operated through numerous clogging situations during which the other pumps continued to clog as described.

Case History No. 3

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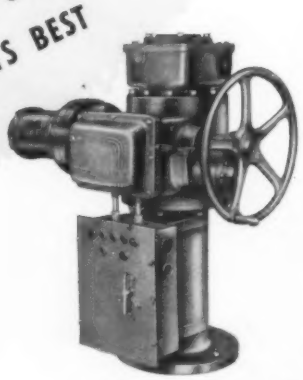
VALVE ACTUATION

ENGINEERING AT ITS BEST



Motor Operated Stand with Integral Control Equipment.

Power actuation is available as a complete carefully engineered unit. Actuation may be by electric motor, air motor, or air or fluid cylinder type motivation. The power unit is compact and self contained, with sturdy supports which attach to the top of any Ludlow Valve.

Manual operation is provided for all electric and air motor operated valves. Our engineers will be glad to help you lay out a plan based on the many years of Ludlow experience in power actuation systems of all kinds for all purposes.

"NO POSSIBLE DIFFERENCE IN FIRST COST CAN OVERBALANCE THE PERPETUAL ECONOMY OF QUALITY."

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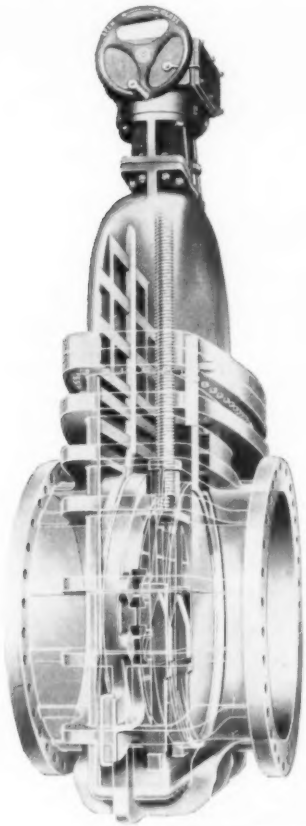
MOTOR OPERATED VALVE

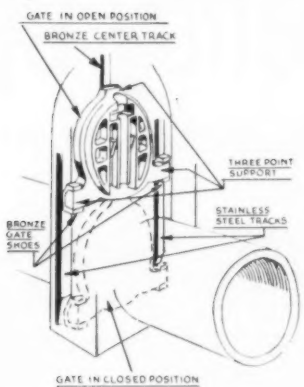
CYLINDER OPERATED VALVE

THE LUDLOW VALVE MFG. CO., INC. TROY, N.Y.

TRADE LUDLOW MARK

GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES
CHECK VALVES • TAPPING SLEEVES • AIR RELEASE VALVES





SQUARE BOTTOM VALVES

The Rensselaer Square Bottom Valve may well be called the "work horse" of the valve family. It is built to stand up under the severe conditions found in automatic operation, throttling, differential pressures and the constant opening and closing found in filtration plants and process industries.

A three-point gate support holds the downstream gate away from its seat ring at all points of travel except the final, fully closed position. Any tendency for the downstream gate to tilt and score the face of the seat ring under conditions of high water velocity or throttling service is eliminated.

At all points this valve is built for long life under constant and severe operation.

IN OPENING: the shoes slide up the stainless steel track inclines to the higher level of the tracks, lifting the gate clear of the bronze seat ring.

IN CLOSING: the gate does not come in contact with the bronze seat ring until the closing point is reached. Even when partly open, the gate is held away from the seat, eliminating all wear due to vibration.

Rensselaer Square Bottom Valves are made in sizes from 4 to 48" with any type end connection. By-passes, spur or bevel gearing, and cylinder or motor operation as desired.

20

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To order these helpful booklets check the reply card inside front cover.

Modern Methods and Materials For Jointing Sewer Pipe

402. In a compilation of reprints and related supplementary material, the Atlas Mineral Products Co., Mertztown, Pa., presents a comprehensive review of all types of sewer jointing materials and methods. You will find this interesting and informative reading. Get a copy by checking the reply card.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 102 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Solids Pump Uses Recessed Impeller

428. The Wemco "Torque-Flow" solids pump works with a completely recessed impeller which creates a vortex effect and transmits power exactly as in a fluid type torque converter. This avoids flow throuh impeller vanes and reduces clogging difficulties when handling sewage sludge or abrasive materials. For full details get Bulletin SP-10 by writing to Western Machinery Co., 760 Folsom St., San Francisco, Calif., or check the reply card.

Catalog on Instrumentation for Sewage Treatment Plants

436. Sewage Treatment Plant operators should have this catalog on instrumentation. Issued by Fischer & Porter Co., Hatboro, Pa., this catalog has plenty of flow sheets showing many of the instrument applications possible in either the trickling filter or activated sludge types of treatment systems. Check the reply card.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Non-Clogging Vertical Wet-Pit Pump Described

182. Full engineering data on Worthington "Freeflow" wet-pit pumps with non-clogging impellers capable of passing solids and stringy material are included in Bulletin W-317 B-12. Check these pumps for sump, sewage and drainage service. Bulletin available from Worthington Corp., Harrison, N. J. Just use the reply card.

Reduce Labor Costs With Power Sewer Cleaners

189. A complete line of sewer cleaning equipment, including labor saving power units and all types of buckets, cables, rods and flushing equipment are listed in Catalog No. 11 of the Turbine Sewer Machine Co., Division of Chas. H. Stehling Co., 1303 N. Fourth St., Milwaukee 12, Wis. Check the reply card for your copy.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described. Check the reply card for your copy.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Get latest data by checking the reply card.

Expansion-Contraction Joints, Sealing Compounds and Waterstops

272. Helpful data to aid in the selection of premolded highway joint fillers and joint sealing compounds, rubber waterstops for concrete construction in water and sewage plants, sewer joint sealers and many related materials are provided in latest literature of Servicised Products Co., 6051 West 65th St., Chicago 38, Ill. Get full details by using the reply card.

Portable Sump Pump Needs No Priming

324. The BJ Pneumatic Sponge Pump, a self-contained air-powered unit, is built for heavy duty dewatering use on all construction jobs. Full details on this lightweight portable sump pump are contained in Bulletin No. 543-3-9000, available from Byron Jackson Pumps, Inc., Box 2017, Terminal Annex, Los Angeles 54, Calif., or by checking the reply card.

"Float-Treat" Process For Industrial Wastes

333. The Rex "Float-Treat" process, a system used to separate greases, chemical flocs and suspended organic matter from industrial waste liquids, is the subject of a new booklet issued by Chain Belt Co., Milwaukee 1, Wis. Detailed description includes plan views, diagrams, photos and text. Get Bulletin 54-82 by checking the reply card.

CONSTRUCTION EQUIPMENT AND MATERIALS

What You Should Know About 6-Wheel Trucks

53. Full information on 6-wheel trucks, both conventional and cab-over-engine models, is contained in a new 24-page catalog now available from Motor Truck Div., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Full color and two color treatment are employed throughout the catalog to present design and operating features of the many different lines of trucks. To get your copy of this valuable catalog check the handy reply card today.

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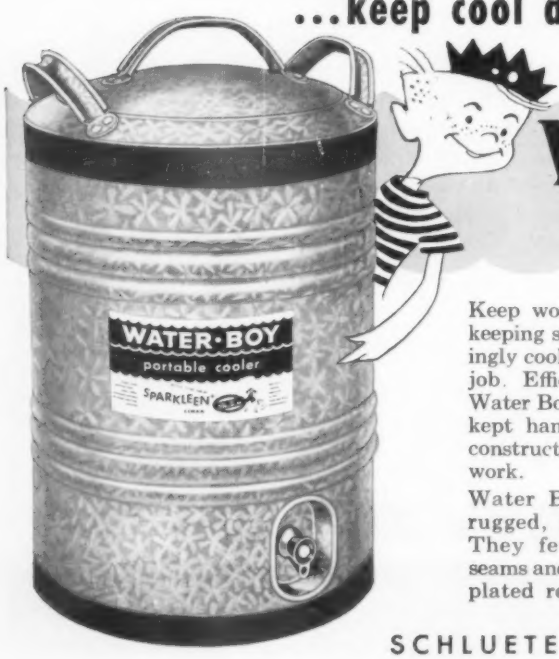
...keep cool drinking water on the job with



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Keep workmen on the job by keeping sparkling pure, refreshingly cool drinking water on the job. Efficiency goes up when Water Boy Portable Coolers are kept handy on every type of construction and maintenance work.

Water Boy Coolers are big, rugged, built to take abuse. They feature double-locked seams and bottoms, brass-nickel plated recessed faucets, fully enclosed or open-rimmed covers. There's the new SPARKLEEN liner, too, that keeps water sparkling clean, odor-free and taste-free.

You'll find Water Boys are a money-saving investment everywhere they're used.

QUALITY HEAVY METALWARE DeLuxe SCHLUETER MFG. CO. ST. LOUIS, MO.

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CLOW CAST IRON PIPE MEETS ALL REQUIREMENTS

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Before specifying pipe for your system, consider these 10 fundamental requirements for any underground pipe for water service.
Clow Cast Iron Pipe meets them all!

LONG LIFE—proved to be 100 years and more
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IMPERVIOUSNESS—no leakage, seepage or sweating
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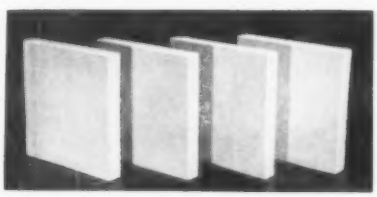

Modern porous plate underdrain systems of FILTROS silica and fused alumina offer new efficiency in water filtration—PLUS installation and maintenance savings. Consider these advantages:

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We will gladly show you how FILTROS can modernize and simplify your filtration system at moderate cost. Write today for complete information.

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Uniform Salt and Cinder Spreading at All Speeds

93. Be sure to investigate the hydraulically operated ground drive offered by Baughman to give you the advantages of two drive speeds and uniform distribution of material regardless of truck speed, without the need for power takeoff or transmission. Full data on this and many other features in Form A-380. Baughman Mfg. Co., Jerseyville, Ill.

Examine a Tractor Piece by Piece

99. The 32-page catalog published by International Harvester Company should be studied by every tractor owner, for in it each unit from engine to track of the TD-2 Diesel is considered separately. These piece by piece discussions are supplemented by notes on easy servicing, versatile applications and attachments for every need. Get your copy of form CR-313-A from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check the handy reply card.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication. Check the reply card for your copy.

Complete Information on Portable Electric Plants

202. New power-packed electric plants that are smaller and easier to move around are fully described in literature available from D. W. Onan & Sons Inc., 3682 University Ave., S. E., Minneapolis 14, Minn. Applications, specifications and optional equipment are covered. Check the reply card.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the reply card.

Trencher Fits Municipal Needs

315. A bulletin describing the Cleveland Model 95 trencher has been published by the Cleveland Trencher Co., Cleveland 17, Ohio. The Model 95, called "The standard machine for city and suburban work", is versatile, maneuverable and economical for use on water lines, service lines, road widening and all utilities trenching. Get this 8-page illustrated bulletin by checking the reply card.

Better Paving On Small Jobs

176. Blaw-Knox Company's small-job paving machine, the Adnun Jr. 8, is the subject of bulletin No. 2609. The Adnun Jr. is equipped with a 12-HP motor. Hopper capacity is approximately 2 tons. It will pave an 8-ft. strip. For full engineering details and on-the-job performance data, get this bulletin from Construction Equipment Div., Blaw-Knox Co., Mattoon, Illinois. Check the reply card.

Handbook on Hot Rolled Carbon Shapes and Plates

412. A handbook every engineer should have on hot rolled carbon shapes and plates has just been released by United States Steel Corp., 525 William Penn Place, Room 5118, Pittsburgh 30, Pa. Check the handy reply card.

"Water Boy" Portable Water Coolers

432. Descriptive literature is available on portable water coolers and cans with the Sparkleen Liner. Sizes, models and price lists are fully covered in bulletins from Schlueter Mfg. Co., 4616 N. Broadway, St. Louis 7 Mo. Check the handy reply card.

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 8 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

A Tractor-Air Compressor Unit

140. "Around the Clock, Around the World" is the title of an 8-page bulletin describing Le Roi's new 125 Tractair, a self-propelled compressor unit with flexible tractor power. Applications, uses, attachments and tools, design and specifications of the compressor and engine are listed. Write Le Roi Division of Westinghouse Air Brake Company 1706 South 68, Milwaukee 14, Wisconsin, or check the reply card for your copy.

Advantages Offered by Aluminum Building Products

460. Strong, light-weight aluminum sheets and extruded sections offer many advantages on public works structures, including weight savings, corrosion resistance, reduced maintenance and attractive appearance. Applications range from roofs and walls to air conditioning and heating duct systems. For names of building products manufacturers who will work with you write Kaiser Aluminum and Chemical Sales, Inc., Kaiser Building, Oakland 12, California, or check the handy reply card.

How to Select Paints For Every Maintenance Need

467. Selecting the right paint for each maintenance need involves consideration of the service to be rendered, conditions of their use and abuse, and the surfaces to which they are to be applied. To help you determine what to use on various surfaces, an industrial paint index printed in the form of a handy file folder has been prepared by the Tropical Paint and Oil Co., Cleveland 2, Ohio. Get a copy by checking the reply card.

Complete Protection Of Iron and Steel Products

242. What are the advantages of Hot-Dip Galvanizing? Why does it offer complete protection at such an economical cost? You'll find the answers in the attractive booklet "Stop Rust", which gives you the full story of the process plus a comprehensive coating comparison chart. Get your copy promptly by checking the reply card or write American Hot-Dip Galvanizers Assn., Inc., 1st National Bank Bldg., Pittsburgh 22, Pa.

Black Top Road Maintenance and Construction Equipment

286. A highly informative, 36-page catalog, covering the entire field of highway and road maintenance equipment has been released by Littleford Bros. Inc., East Pearl St., Cincinnati 2, Ohio. Units described and illustrated include distributors, supply tanks, sprayers, brooms, rollers, heater-planer, asphalt kettles and accessory tools. Check the handy reply card for your copy of this valuable catalog.

●

STREETS AND HIGHWAYS

Get Full Data On Aggregate Spreaders

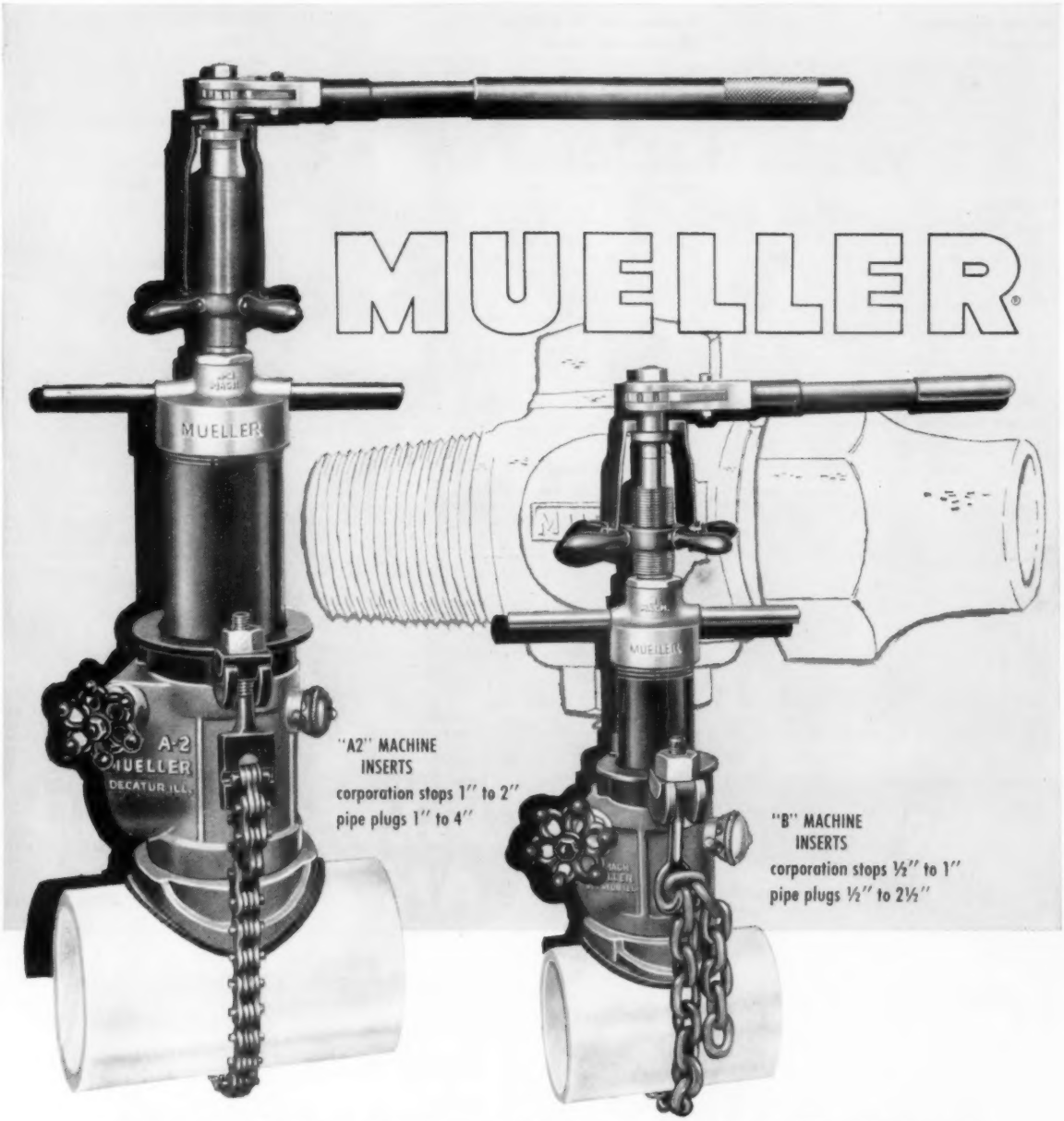
34. Accurate control for spreading asphalt, crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on towed, truck mounted and tailgate types available by checking the reply card. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

What's Your Digging Problem? Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 140° arc and dig to a depth of 10 feet. For full details check the reply card. Sherman Products, Inc., Royal Oak, Mich.

How to Select Prestressed Concrete Bridge Members

26. Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the reply card for your copy of this helpful reference bulletin.



Insert Corporation Stops Under Pressure

Drill the main, tap the hole and insert corporation stops with the Mueller "B" or "A-2" Tapping Machine. Or you can use them to remove and replace old corporation stops or insert pipe plugs—*all under pressure.*

Drilling and tapping operation are done simultaneously with a combined drill and tap. Both machines use a single boring bar for drilling, tapping and inserting operations. This assures accurate alignment for inserting the stop—eliminates the possibility of cross-threading.

Combination by-pass and test valve relieves pressure and permits operator to check for leakage after stop is inserted and before machine is removed.

Refer to Mueller Catalog W-96, contact your Mueller Representative, or write direct for complete information.

MUELLER CO.

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MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Need more facts about advertised products? Mail your Readers' Service card now.

To order these helpful booklets check the reply card inside front cover.

Calcium Chloride for Roads

98. A 24-page booklet "The Why of Wyandotte Calcium Chloride for Roads" is available from Wyandotte Chemicals Corporation, Michigan Alkali Division, Wyandotte, Michigan. The booklet explains in copy and pictures why calcium chloride has become so widely adopted for the treatment of unpaved road surfaces. Also, such topics as elimination of gravel loss and reduced blading are covered. Check reply card for your copy.

How to Get Better Grader Operation

111. A most interesting and instructive 20-page illustrated action booklet on how to operate a motor grader is now available from Galion Iron Works & Mfg. Co., Galion, Ohio. Designed to help operators get more effective use from the versatile motor grader, this booklet covers the hydraulic system, steering, tips on leaning wheels, proper blade positioning, turning, gear speeds and operating procedures. Colorful, easy-to-read presentation guarantees good readership. Check the reply card for your copy.

Latest Data on Prestressed Concrete Lighting Standards

265. Comprehensive data on prestressed concrete standards for street and highway lighting is contained in a 24-page catalog which contains complete engineering tables and descriptive information on design features, mounting arrangements, base type choices and specifications of Hy-Lite standards. Get helpful and easy-to-read Catalog No. 300 by writing to American Concrete Corp., 5092 No. Kimberly Ave., Chicago 30, Ill., or check the reply card.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the reply card for your copy.

Grading Can Be Faster, Cheaper and Easier

96. You'll like every feature of the Austin-Western 99H Grader. It has all-wheel drive, all-wheel steer, controlled traction, precision sideshift and a high lift, extreme reach, reversible blade. Get data from Austin-Western Works, Baldwin-Lima-Hamilton Corp., Aurora, Ill., by checking the reply card.

Equipment For Highway Stabilization

363. The Roto-Mixer and Preparator are machines available for low-cost road building and stabilization. For operation, uses and specifications get literature from Road Machinery Div., Wm. Bros Boiler & Mfg. Co., Minneapolis 14, Minn., or check the handy reply card.

Economical Scraper Handles Many Heavy Jobs

398. Among the many applications of the versatile Model D Tournapull are: grading and building roads; handling garbage disposal; and grading, leveling and terracing. For details on how its speed, power and ability to work either as a self-loading tool can help your production and lower your costs, write Le Tourneau-Westinghouse Co., Peoria, Ill., or check the reply card.

Cold Asphalt Emulsions For Hot-Mix Pavements

411. A new, 4-page illustrated bulletin that provides detailed information on Laykold asphaltic concrete and Bit-U-Mix paving mixtures for all types of road construction is available from American Bitumuls & Asphalt Co., 200 Bush St., San Francisco, Calif. Check the reply card.

Information on A-C Model D Motor Graders

430. The design, engineering, construction and performance story of the Allis-Chalmers 50 hp Model D motor grader is completely told in a 16-page 2-color catalog available from Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wisc. Features, specifications, attachments and accessories are fully covered. Check the reply card.

Better Highways Through Salt-Soil Stabilization

123. Shoulder stabilization is the subject of a new booklet in the series of informative pamphlets issued by International Salt Co., Inc., Scranton, Pa. Step-by-step illustrations show construction procedures in detail. For practical information on this important subject check the reply card today.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the reply card today.

The Modern Approach to the Brush Problem

222. Eliminate your brush disposal problem by using an Asplundh Chipper. For complete information on what the Chipper can do, how it can save on costs, various types available and other outstanding features write to Asplundh Chipper Co., 505 York Road, Jenkintown, Pa., or check the reply card.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Machine Co, Winona, Minn. Also information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the reply card.

Complete Information on Wain-Roy Back Hoe

459. Complete information on a self-contained back hoe that is designed to fit Payloader tractor-shovels and International crawler tractors is available from Wain-Roy Corp., Dept. C, Hubbardston, Mass. Included are specifications, types and many exclusive features. Check the reply card today.

LOWEST COST PIPE INSTALLATION...

Send COUPON Today!

Hydrauger Corp., Ltd.
681 Market St., San Francisco, Calif.
Please send, without obligation to me, the HYDRAUGER BOOKLET which shows relative costs and speeds of BORING as well as specifications of various Hydrauger models.
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2" to 24" BORES - Up to 250' long.

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AVOIDS EXCESSIVE TRENCHING

Hydrauger bored holes for pipe installation invariably reduce costs 80% to 90% by eliminating trenching and back-filling to say nothing of man-hour labor savings and safety to highway traffic.

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FILTER SAND AND GRAVEL

Produced from an inland pit hence free from river contamination and foreign matter.

Shipment in bulk or bagged.

Many of the larger filter plants throughout the United States are equipped with our products.

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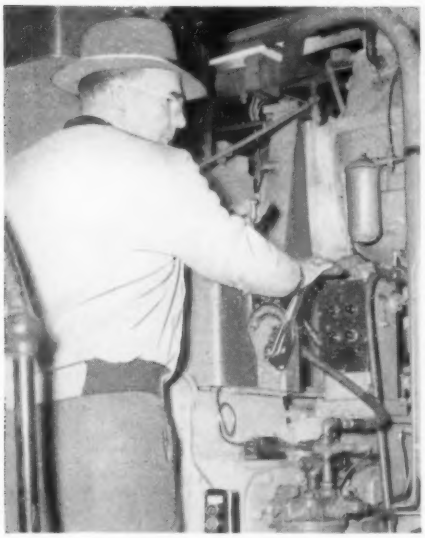
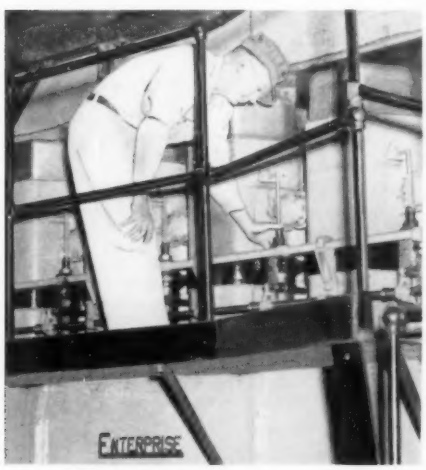
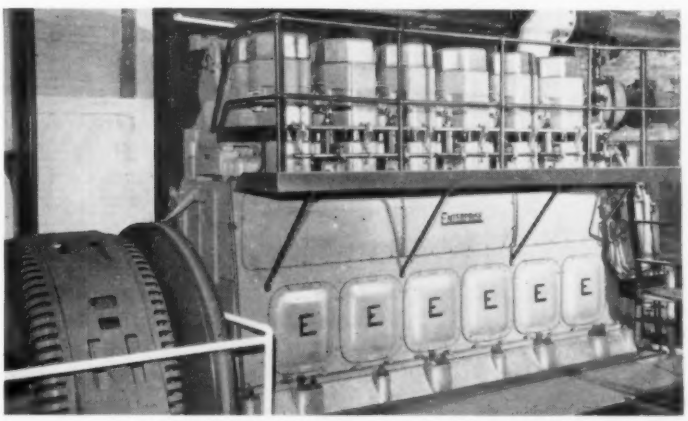


At the Dual Fuel "Select-O-Matic"® control, "Pete" Leslie demonstrates ease of change-over from dual fuel to straight diesel operation of 1000 kw Enterprise. Engine never drops a cycle changing either way!

"We Added an Enterprise Dual Fuel Engine—Now Save $700 a Month on Fuel and Lube Oil Alone!"

Says JAMES J. LESLIE, Superintendent, Paulding Light & Water Works, Ohio





The 1400 HP Enterprise has logged over 21,000 hours without any major maintenance. Valves have not been ground, rings never replaced. No overhaul will be planned until there is some evidence of work required!

Chief Engineer Perry "Jack" Jackson on routine inspection of Enterprise Turbocharged Model DGSQ-316. After two and one half years on local natural gas and diesel fuel oil No. 2, firing pressures and exhaust temperatures have remained exceptionally even.

"Our Enterprise is one of four diesels in the plant, and it carries almost all of the load, 24 hours a day. That's because it's the most economical and dependable engine we've ever operated. Whether it's on dual fuel in normal periods, or on straight diesel during light loads of 300 kw or less, this engine performs very, very well. We like the safe margin of reserve it gives us, too—even during peaking periods."

Mr. "Pete" Leslie points out what a really profitable power plant means to the city of Paulding. Electric rates have been reduced substantially. Street lighting, power for the City Hall, and a beautiful municipal swimming pool have been provided at no cost to taxpayers.

This is another example of how cities and towns throughout America benefit from dependable Enterprise Engines. Write us today for full information, or call your nearest Enterprise office. Models from 73 to 7703 HP in diesel, dual fuel, tri-fuel and spark ignited gas engines.

Over a million horsepower at work the world over!

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Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc. Check the reply card today and full details will be sent.

Advanced Tractor Design Gives Better Performance

399. The Ford Tractor offers 4-wheel stability, built-in hydraulic system, power take-off, as well as greater power, performance and economy. A complete booklet describes five tractor models in two power series, showing the latest in advanced tractor design and including many applications of equipment for saving time and money. For your copy check the reply card or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

Inexpensive Ditcher Handles Heavy Diggings

91. The Shawnee Scout Ditcher, a heavier model for extensive digging, has been added to the Shawnee line of ditchers and doozers. All models are designed to handle ditching and backfilling operations quickly, efficiently and at low cost. Full information on this equipment will be sent by Shawnee Mfg. Co., 1947 N. Topeka, Topeka, Kansas. Just check the reply card.

Window Loader is Tailor Made for Majority of Highway Needs

296. The peculiar problems of windrow loading require in most cases a medium capacity, low cost, highly maneuverable machine. To meet these needs Barber-Greene Co. now has a 4 cu. yd. per min. Windrow Loader, mounted on a John Deere wheel tractor. Further details may be obtained from Barber-Greene Co., Aurora, Ill. by checking the reply card.

TASSCO TOMCAT

ALL-ALUMINUM

STREET NAME SIGNS THAT PUT YOUR TOWN ON THE MAP...AND KEEP IT THERE!

Clear, vivid and perfectly legible! This is the street name sign that has earned the highest acclaim of hundreds of up-to-the-minute communities throughout the land.

WHY?

The Tassco Tomcat is easily readable by night as well as by day.

"Scotchlite" makes the Tassco Tomcat highly reflective, and from any angle, thanks to Tassco eye-angle design.

It is virtually indestructible and tamperproof, weatherproof, boltless . . . all aluminum construction.

The Tassco Tomcat is clean in design, enhancing the modern, friendly decor of typical American communities.

COST?

No higher, and frequently much less than ordinary framed porcelain or embossed signs.

WRITE FOR "A Guide to Effective Traffic Safety"

The Sign of TASSCO Traffic Safety

TRAFFIC and STREET SIGN COMPANY

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Dust Control Made Easy

30. Details on an effective solution for your dust annoyance problems are presented in a colorful bulletin. "Gulf Sani-Soil-Set—the modern, proven agent for controlling dust." Get your copy to learn how this long-lasting, easily applied material can be of help. Write Gulf Oil Corp., 1822 Gulf Bldg., Pittsburgh 30, Pa. or check the reply card.

Getting Specified Density In Granular Bases and Fills

188. Vibratory compactors offer the means for getting specified density in rock, slag, soil-bound macadam, gravel and sand base courses. Just one pass may suffice. Get complete information from Jackson Vibrators, Inc., Ludington, Mich. See how adaptable compactor units handle a variety of compaction needs. Check the reply card today.

What Should You Look For In a Power Sweeper?

206. Helpful information to aid you in the selection of a power sweeper to fit your needs is provided in Bulletin 85.2, issued by G. H. Tennant Co., 2530 N. Second St., Minneapolis 11, Minn. Full data on the highly maneuverable Tennant Model 75 Sweeper is included. Get your copy by checking the reply card.

Traffic Paints That Last a Long Time

274. Traffic paints with the Parlon-Pentalyn formula, that has long wear, dries quickly, has excellent adhesion, provides an excellent bond for glass beads and can be applied by flow or spray is described in a bulletin just released by Cellulose Products Dept., Hercules Powder Co., Wilmington 99, Del. Check the reply card today for your copy.

STREET LIGHTING AND TRAFFIC CONTROL

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy coupon. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn. Use the reply card.

Fluorescent Street Lighting For the Whole Community

128. Literature on the 5 new G-E fluorescent luminaires, each designed for a different area, is available from Section 452-166, General Electric Co., Schenectady 5, N. Y. Fluorescents for residential, secondary and primary traffic, main streets and whiteway areas are fully described. Features to simplify installation, lower maintenance and to give maximum performance are explained in drawings and photographs. Check the handy reply card today.

A Guide to Effective Traffic Safety

468. A 20-page catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestarn traüc areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs. For your copy check the reply card today.

Engineering Guide to Mercury Street Lighting

380. Basic engineering aspects of mercury vapor street lighting are discussed in a 35-page Engineering Guide available from Westinghouse Corp., Box 2099, Pittsburgh 30, Pa. This practical reference includes technical data on mercury lamps applicable to general lighting service, operating characteristics of the system and a discussion of methods of economic evaluation of alternative lighting systems. Check the reply card for your copy of this helpful guide.

New! The Sherman Major Power Digger

with Many Advanced Features to Increase Versatility and Earning Power

The all new Sherman Major Power Digger has been engineered to take full advantage of the ruggedness and economy of the Fordson Major Diesel Tractor. This heavy-duty unit will dig 12 feet below grade, reach 18 feet 3 inches behind the tractor rear axle, dig throughout a swing arc of 180° and will carry a full bucket to a height of 8 feet 8 inches for loading trucks.

Additional features of the new Sherman Major Power Digger include twin crowd cylinders, heavy steel plate construction, large diameter hinge pins, heavy steel castings, replaceable hardened steel bearings at hinge points, and a newly designed dipstick, boom, cylinders, bucket and sub-frame assembly.

Write for bulletin No. 541.

See the Sherman Major Power Digger soon at your local **FORD TRACTOR DEALER**

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN
POWER DIGGERS* • FRONT END LOADERS • FORK LIFTS
Shermanized SP Products®

*Designed, Engineered and Manufactured jointly by Sherman Products, Inc., Royal Oak, Michigan. Wain-Roy Corporation, Hubbardston, Mass.

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REFUSE COLLECTION AND DISPOSAL

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I., N. Y. Check the reply card now to learn how your collection problems can be eased.

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a solution, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check reply card or write Gar Wood Industries, Inc., Wayne, Mich.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check the reply card today for catalog No. 1702 from Flynn and Emrich Co., Holliday and Saratoga Sts., Baltimore 2, Md.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio,, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included. Check the reply card today.

New M-B Packer Body Designed for Maximum Payload

309. The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, all safety features. Available in 12-14-16, 20, 24 cu. yd. capacities. Get all the facts from M-B Corp., New Holstein, Wis.

For Prompt Service Use The Reply Card

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 8, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

What You Should Know About Refuse Incinerators

362. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the reply card.

WEED AND INSECT CONTROL

Investigate "Tifa" For Insect Control

47. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use reply card for full data on public health programs. Products Div., Todd Shipyards Corp., Columbia & Halleck Sts., Brooklyn 31, N. Y., Greens Bayou, Houston 15, Texas.

Chemicals for Complete Weed Control

79. "Ureabor" weed and grass killer completely destroys vegetation about fence lines, parking lots, storage areas and similar places. Ease of application and maximum long-lasting results make this material the choice where a nonselective herbicide is required. For latest data write Pacific Coast Borax Co., 630 Shotto Pl., Los Angeles 5, Calif. or check the reply card.

Weed Killing Case Histories

205. Long term weed and grass control . . . costs less with Du Pont "Telvar" weed killers. Interesting folder published by Grasselli Chemicals Dept., E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. Full color photographs demonstrate effective action; text shows application methods for best results. Check the reply card for your copy.

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

Weed control saves money here

Chemical weed and brush control pays off anywhere, but especially in hard-to-cut places like this. One spraying not only improves the appearance but saves hundreds of man-hours.

Whatever your weed and brush control requirements, DIAMOND has the information and the solution. As one of the world's largest makers of herbicides, DIAMOND has the experience and the facilities to help you select the right chemical formulation for the job. For information, write DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, O.

DIAMOND CHEMICALS

Diamond Chemicals

1 COILFILTER Replaces 2 Cloth Filters at Conshohocken, Penna.

The sewage treatment plant at Conshohocken, Penna. was originally a primary treatment plant employing two 100 Sq. Ft. cloth type filters for sludge dewatering. In 1954, when the plant was enlarged to include secondary treatment, these filters were replaced by *one* 100 Sq. Ft. Komline-Sanderson permanent filter media COILFILTER, dewatering digested primary and activated sludge. One COILFILTER is now substantially outperforming the record of two cloth filters—at a saving in overall power requirements, labor, maintenance, operating time and chemical consumption. Population served 12,200. Average flow .850 MGD

Clarence H. Cooper, Conshohocken Plant Superintendent, says:

"The application of the Coilfilter to our particular plant has resulted in outstanding performance. This unit replaces two old style cloth type filters whose operation and maintenance costs were entirely unsatisfactory. We feel the Coilfilter embraces truly sound design and exceptional performance, a combination that reflects in a savings of chemical usage and maintenance costs. We are always proud to demonstrate the efficient operation of the Coilfilter and feel your unit has contributed greatly to the overall success of our entire operation".

Engineers: Albright & Friel

At right are shown three views of the Conshohocken Coilfilter

Write for Bulletin No. 103

KOMLINE-SANDERSON ENGINEERING CORPORATION

Peapack, New Jersey

Manufacturers of

COILFILTER Sludge Vacuum Filters

To order these helpful booklets check the reply card inside front cover.

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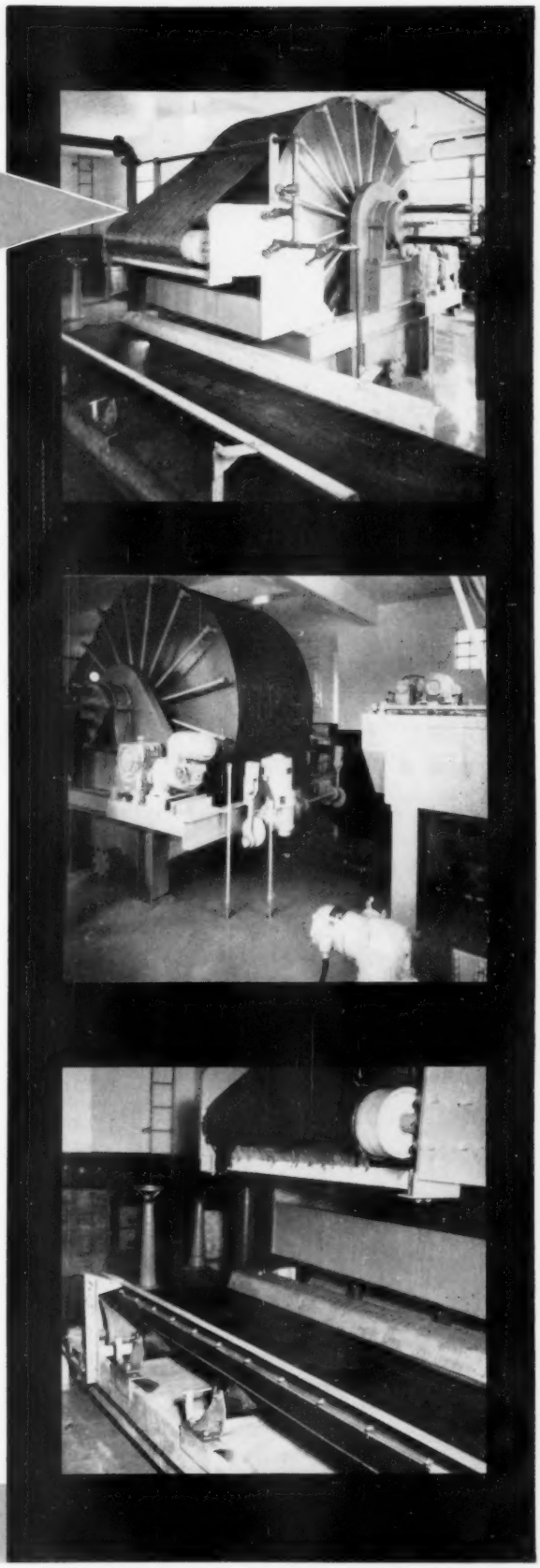
Engineers: Albright & Friel

At right are shown three views of the Conshohocken Coilfilter

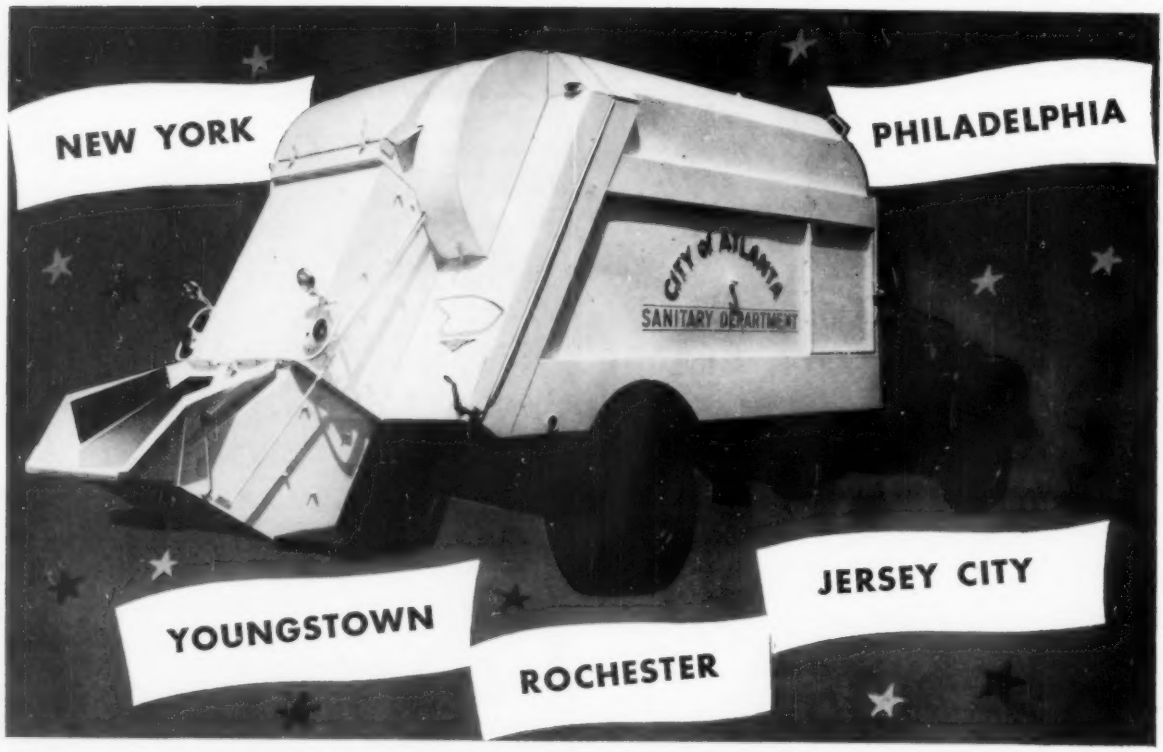


Write for Bulletin No. 103

KOMLINE-SANDERSON ENGINEERING CORPORATION
Peapack, New Jersey

Manufacturers of
COILFILTER Sludge Vacuum Filters

Get full details of this month's products . . . mail your Reader's Service card today.



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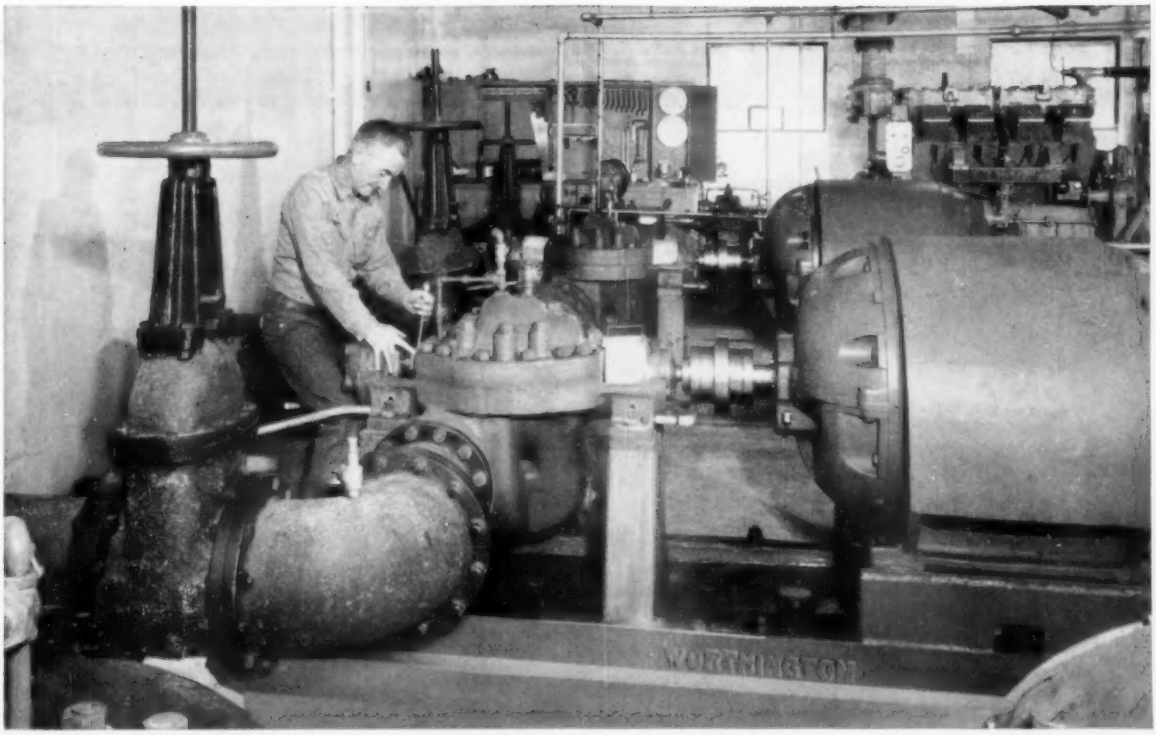
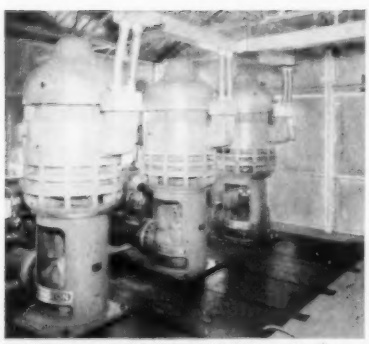


SIX MILLION GALLONS of water per day are delivered to City of Colorado Springs by three Worthington 400-hp centrifugal pumps, like that in foreground, at Lake George Pumping station. A 200-hp engine-driven Worthington is on standby service. This installation was engineered by Black and Veatch Co. of Kansas City, Mo.

15 Worthington pumps supply water to fast-growing Colorado Springs



THREE 300-HP WORTHINGTON vertical turbine pumps move well water from common sump to Colorado Springs' Fort Carson supply line.

A population up 50% in 10 years, an expanding industry, the new Air Force Academy—all these have spurred the demand for water in the City of Colorado Springs.

The job of supplying the city with an additional 6 million gallons of water a day falls to the Worthington-equipped Lake George and Secondary Pumping stations. Together, these stations pump water through a total pipeline distance of 92,810 feet with a lift of 1,580 vertical feet. Each station contains three 400-hp Worthington centrifugal pumps each of 2-mgd capacity. A 200-hp gasoline-engine-driven pump on standby service in each station provides minimum flow in case of power failure to prevent possible freezing of the lines.

Colorado Springs also obtains water from Fountain Creek Valley. This water is pumped to a common sump by four 30-hp pumps and from the sump to the distribution system by three 300-hp pumps—all seven pumps being Worthington vertical turbines.

The Colorado Springs water works installation is typical of thousands using rugged, reliable Worthington public works equipment—pumps, engines, compressors, turbines. Worthington engineers will be glad to help you apply this equipment to *your* water works or sewage needs. Write Worthington Corporation, Public Works Division, Harrison, N. J. W. 6. 1

WORTHINGTON

ALL MAJOR PUBLIC WORKS EQUIPMENT UNDER ONE RESPONSIBILITY

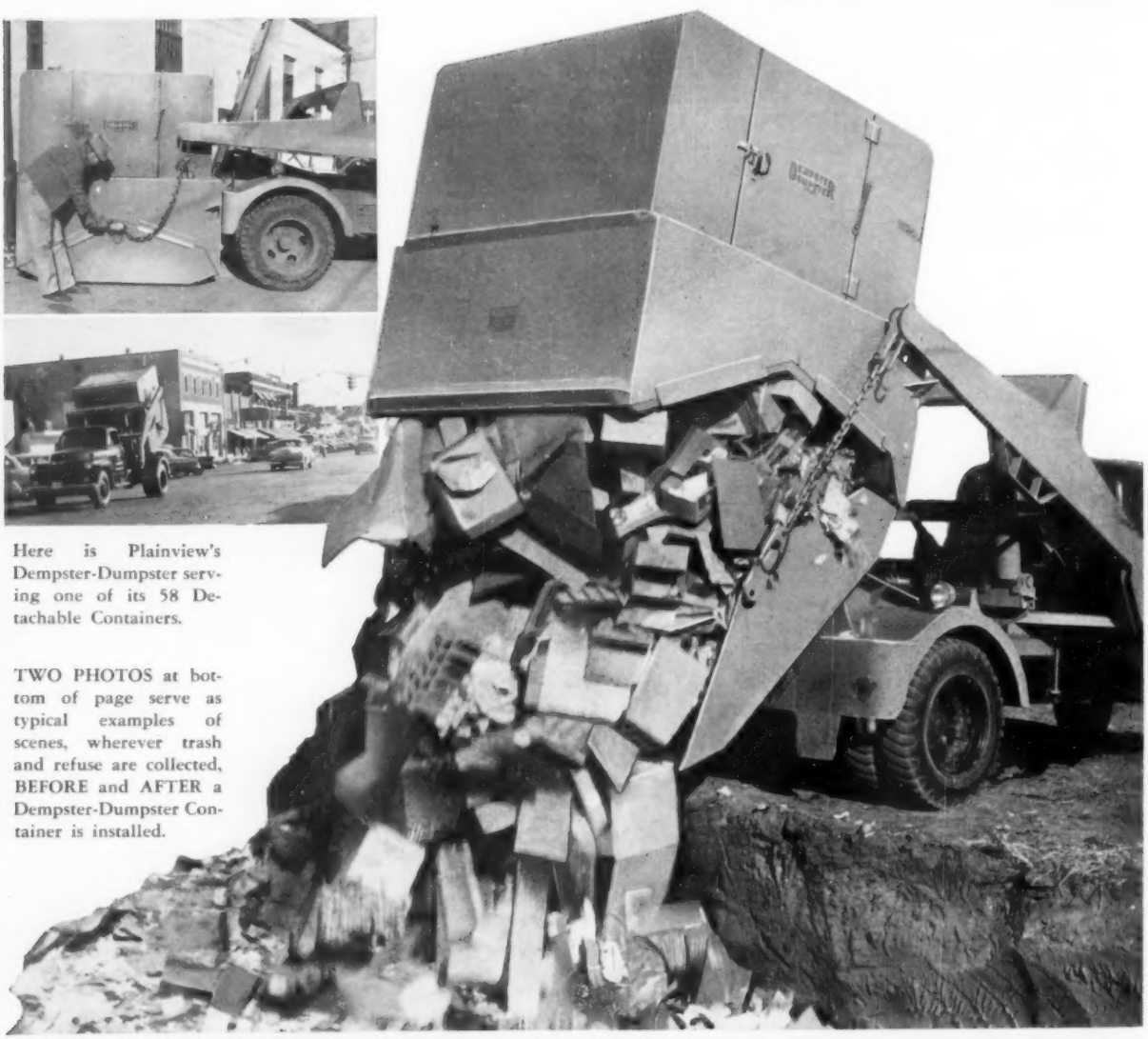
Water Works Pumps • Sewage Pumps • Comminutors • Vertical Turbine Pumps • Vacuum Pumps

Now's the time to mail this month's Readers' Service card.

Look what's happening

Here is Plainview's Dempster-Dumpster serving one of its 58 Detachable Containers.

TWO PHOTOS at bottom of page serve as typical examples of scenes, wherever trash and refuse are collected, BEFORE and AFTER a Dempster-Dumpster Container is installed.



DEMPSTER

5115

to bulk refuse collection!

Cities, large and small, installing Dempster-Dumpster System featuring large capacity fire-proof, scavenger-proof steel Detachable Containers. Scores of them handled by only one man . . . cutting cost tremendously!

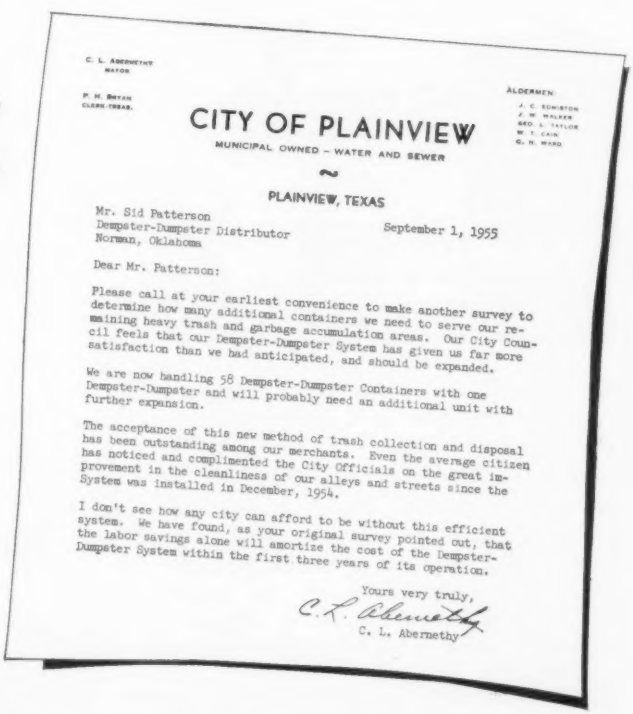
THERE IS A WAY to eliminate your bulk refuse handling problem . . . open cans, crates and boxes with overflowing refuse . . . rats feeding on it . . . wind scattering loose rubbish . . . dogs and cats munching in the mess . . . flies buzzing around the stuff—a costly potential in disease and fire hazards alone in damage to persons and property. And, the equipment and labor cost of collection is tremendous. There's a simple, economical and nationally recognized solution to this problem. Big steel Dempster-Dumpster Containers located at convenient bulk refuse accumulation points—each equivalent to 75 ordinary trash cans—in your business areas . . . in housing and apartment areas . . . at schools, hospitals, etc. Scores of them—25, 30, 40, 50—served on schedule by only one man, the driver of your truck-mounted Dempster-Dumpster.

You can understand why officials like Mayor Abernethy of Plainview say: "I don't see how any city can afford to be without this efficient system." Praiseworthy satisfaction is the result in other cities—Borger, Pampa, Odessa and Lubbock in Texas, for instance. Atlanta . . . Baltimore . . . Davenport, Iowa . . . Henderson, Ky. . . . Jackson, Tenn. . . . Lakeland, Fla. . . . Wilmington, N. C. . . . Richmond, Va. . . . Rochester . . . New York City . . . Denver . . . Montgomery, Ala. . . . Wyandotte, Michigan and many, many others.

Invariably, wherever this system is installed, one finds immediate praise of an outstanding improvement from merchant users and citizens alike. Without question, the Dempster-Dumpster System is recognized as the most sanitary and lowest cost method of bulk refuse collection ever devised. Ask us to send you complete information. Write today! Manufactured exclusively by Dempster Brothers, Inc.

"How can any city do without it--" says Plainview's Mayor Abernethy.

Wherever the Dempster-Dumpster System is in use, satisfaction beyond that anticipated is the same as expressed here by Mayor Abernethy. Your city, too, can save thousands of dollars and, at the same time, eliminate fire and health hazards and improve the cleanliness and appearance of your heavy producing districts with this amazing system. A survey of your bulk refuse collection may be arranged without obligation.



C. L. ABERNETHY
MAYOR

P. H. BRYAN
CLERK-TREAS.

ALDERMEN:
J. C. EDMISTON
J. W. WALKER
GEO. L. TAYLOR
W. T. CAIN
O. N. WARD

CITY OF PLAINVIEW
MUNICIPAL OWNED – WATER AND SEWER

PLAINVIEW, TEXAS

Mr. Sid Patterson
Dempster-Dumpster Distributor
Norman, Oklahoma

September 1, 1955

Dear Mr. Patterson:

Please call at your earliest convenience to make another survey to determine how many additional containers we need to serve our remaining heavy trash and garbage accumulation areas. Our City Council feels that our Dempster-Dumpster System has given us far more satisfaction than we had anticipated, and should be expanded.

We are now handling 58 Dempster-Dumpster Containers with one Dempster-Dumpster and will probably need an additional unit with further expansion.

The acceptance of this new method of trash collection and disposal has been outstanding among our merchants. Even the average citizen has noticed and complimented the City Officials on the great improvement in the cleanliness of our alleys and streets since the System was installed in December, 1954.

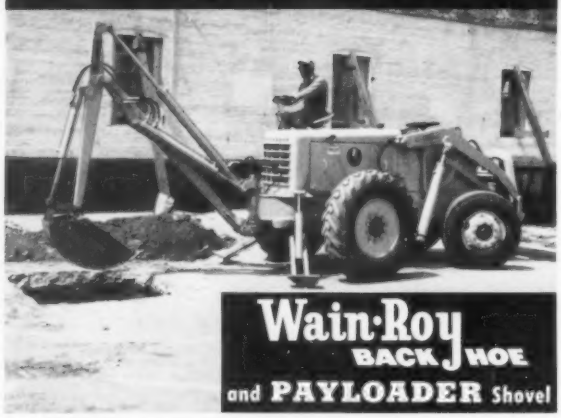
I don't see how any city can afford to be without this efficient system. We have found, as your original survey pointed out, that the labor savings alone will amortize the cost of the Dempster-Dumpster System within the first three years of its operation.

Yours very truly,
C. L. Abernethy
C. L. Abernethy

BROTHERS 956 Dempster Bldg., Knoxville 17, Tennessee

Need more facts about advertised products? Mail your Readers' Service card now.

2 versatile BACK-HOE combinations



Keep both ends of your "PAYLOADER" profitably employed — digging trench, bell holes, etc. with the hoe — backfilling, excavating, material handling with the front end shovel. A complete, balanced unit that handles scores of jobs on paved or unpaved surfaces.

Hoe may be attached or removed in less than 30 minutes. Digs 18″ to 36″ trench, in 190° radius, down to 12′-6″. Special buckets available. Actuated bucket, powerful breakout force assure big yardage at all times. For details see your I-H Industrial Power Distributor or write direct.

A low cost, versatile unit that combines back-hoe and backfill blade for all types of trenching and excavating. 6′ backfill blade, angles right or left, raises and lowers hydraulically.

Hoe is completely self-contained unit — on or off in less than 30 minutes. Digs in 190° radius — buckets 14″ to 36″ available — digging depth to 11′. Actuated bucket adds tremendous extra digging power to teeth. Many other superior features. For details see your I-H Industrial Power Distributor or write direct.

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Hubbardston, Mass.

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Colorimeter Mod. 450 for Nessler Tubes

A new photoelectric instrument of high accuracy for the measurement of pale colors and faint turbidities.

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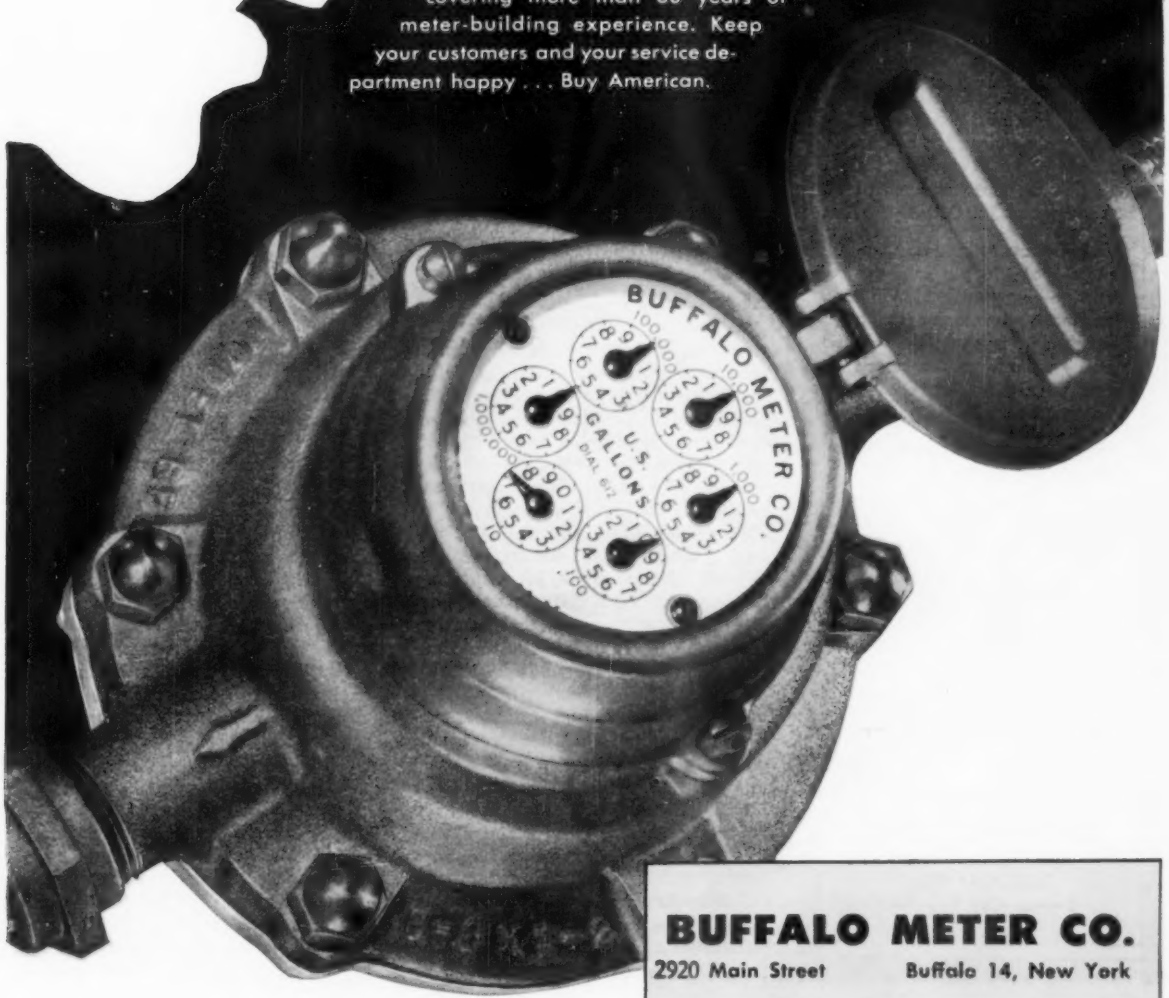

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COSTLY DISPOSAL OF TREES

REMOVED FROM STREETS, PARKS & RIGHT-OF-WAYS

Now a plan has been developed by the Belsaw Machinery Company that has turned this ever-present problem into a money-saving operation. In fact, this plan has already helped Kansas City, Missouri, solve its tree disposal problem at a savings of $20,000 a year.

The Belsaw Plan is complete—easy to put into operation—inexpensive. While originally developed for a large city, it is a plan that easily adjusts to the needs and operations of smaller communities.

Write us today for complete details of this plan which solves a major disposal problem in a money-saving way!

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For Over 30 Years Manufacturers of Money-Saving Equipment for the Wood Products Industry.

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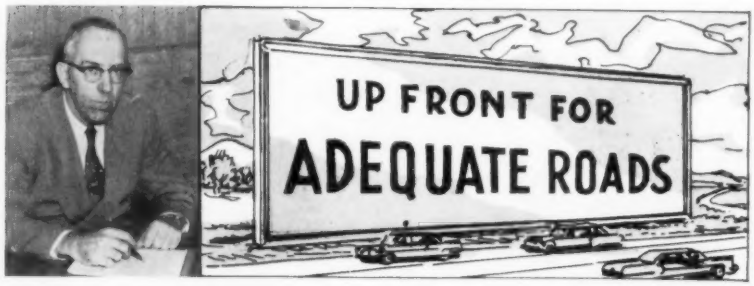


by **LEO J. RITTER, JR.**
Highway Consultant

Electronic Computers — The application of electronic computers to the solution of many numerical problems in highway engineering is receiving more and more attention. Evidence the "high-level" conference held early in March in Chicago. Attended by many top-level state highway engineers and officials from across the country, two full days were devoted to the subject of improved engineering methods and procedures, with particular emphasis on aerial photogrammetry and electronic computers. Sorry we didn't get to attend some of it, but we happened to be in Washington at the time.

Meanwhile, Bendix has reported results of a sample earthwork calculation on its new G-15A computer, now in full production. In the sample problem, computations were done on a 3-mile section of highway involving 230 cross sections. The savings over manual computations are tremendous. With the machine—after a "program" has been worked out for each different type of problem—the time spent in preparing the data for each cross section is from 1 to 1½ minutes. The actual time in the machine is 15 seconds. Thus, each cross section is computed in from 1¼ to 1¾ minutes. Manually, the time required would be at least 30 minutes. Bendix estimates that, considering the expense of labor against the cost of running the computer, operating costs are greatly in favor of the computer—on the order of 15 to 1.

Just in Case — Just in case somebody stops you on the street and asks you, there are now 3,395,000 miles of highways and streets in the United States, of which 3,030,000 miles are rural. Please note—2,331,000 miles of this total are under county or other local supervision and 365,000 miles are in cities and towns. This leaves the state highway departments a paltry 607,000 miles. The federal government has control over only 92,000 miles of roads; this is a major difference between our highway system and those of most other countries of the world, where all rural highways are usually under control of the national government.

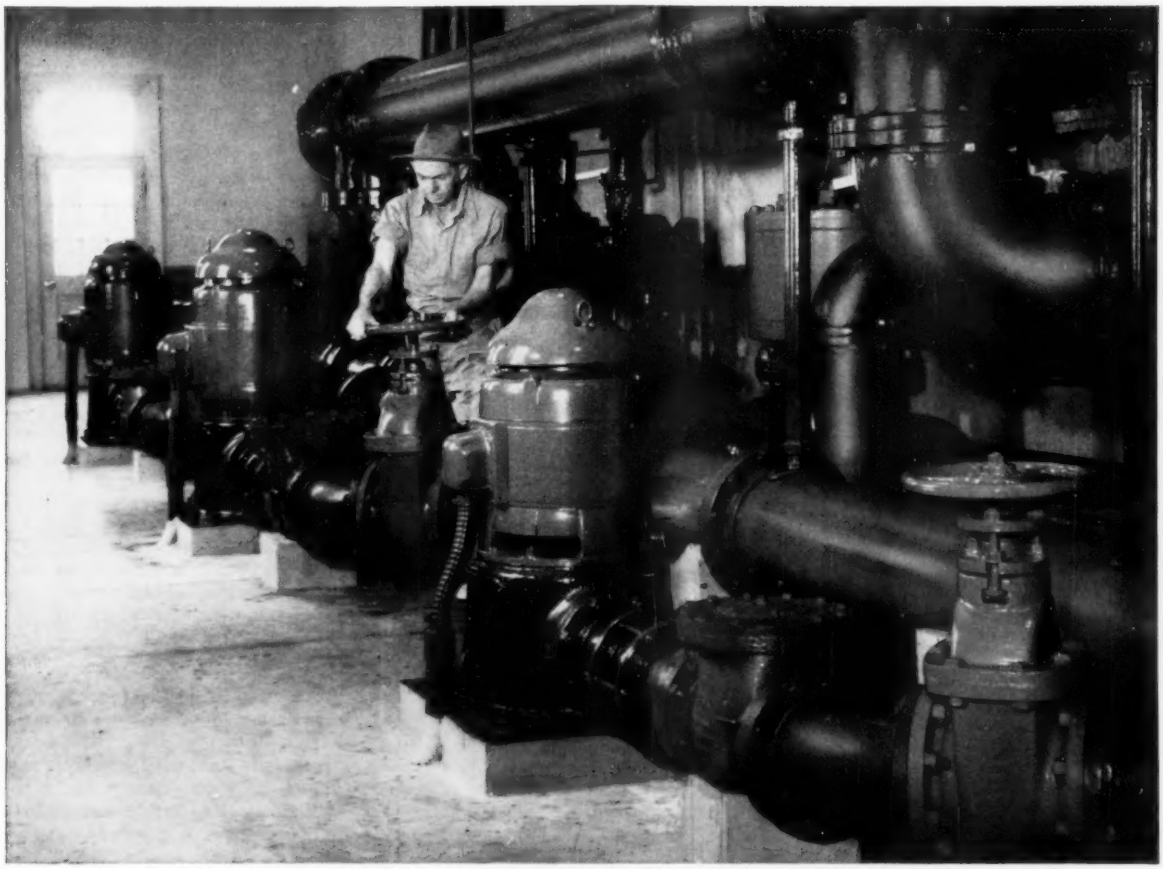
Soil Stabilization — Some interesting experiments in soil stabilization are being conducted by the Indiana State Highway Commission, using a new (at least to us) chemical. The material is a quaternary ammonium salt made from tallow.

In one location, a test strip 400 feet long and 22 feet wide is being evaluated. The subgrade is clayey in character. The salt was added to the raw soil and the strip surfaced with one inch of bituminous mix. A control strip was built in an adjacent section, utilizing 5 inches of aggregate as a base course, and the same one-inch wearing course.

At another location, where the subgrade soil is predominantly silt, two test strips were built. On one strip the new soil was treated to a depth of 6 inches. The other was treated to a depth of 3 inches and then topped with two inches of aggregate. Both had one-inch bituminous surfaces; a control strip was also built by applying one inch of surface course to the raw soil.

Purpose of the tests is, of course, to evaluate the material for subgrade stabilization, hence the minimum pavement structures used. It is too early for any evaluation, obviously. However, during construction, it was noted that the chemical aided in the compaction process. A section of the treated unsurfaced soil was left exposed to the weather last fall and is reported to have behaved satisfactorily.

Georgia Tech—Our old friend and associate, R. J. Paquette, sent us a batch of material covering recent activities in highway engineering at Georgia Tech. Interesting reading. Included was a program of the dedication of the new Joint Research and Laboratory Building on February 29. This building houses research



THREE WORTHINGTON VERTICAL TURBINE PUMPS lift water 66 feet in the dual-purpose water treatment plant in Pulaski, Virginia.

Pulaski's new plant softens hard water, hardens soft water

Seems that the main source of water for Pulaski, Virginia, is a small impounding reservoir where the water is extremely soft.

When the reservoir runs low, Pulaski draws from a limestone spring. Water here is unusually hard.

To deliver water of uniform quality all year 'round, the Pulaski plant has to soften the hard water — and harden the soft water.

Pumps for this unique plant were supplied by Worthington. Three Worthington vertical turbine units transfer water from the plant's clear well to the general distribution system. Pulaski's engineers are well pleased with the Worthingtons because they take up so little floor space and need no priming facilities or foot valves. The three pumps are installed in a 16-foot deep clear well and lift water 66 feet at exceptionally high pumping efficiencies.

Why not learn how the modern Worthington vertical turbine pump can help in your operation? Write for free Bulletin W-450-B40 to Worthington Corporation, Vertical Turbine Pump Division, Harrison, New Jersey. D.4.28

WORTHINGTON

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

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OFFICE OF SUPERVISOR OF ROADS
COUNTY OF BERGEN

J. ERNEST THIER, SUPERVISOR
DIAMOND 2-1350

70 ZABRISKIE STREET
HACKENSACK, N. J.

May 26, 1955

Mr. W. O. Forman, President,
Fitchburg Engineering Corp.,
Fitchburg, Massachusetts.

Dear Mr. Forman:

I thought I would take five minutes out to inform you about the efficient work your Fitchburg Chipper is doing in Bergen County.

As you probably well know, this Department maintains 450 miles of County road, much of it in the rural area, and formerly, when cutting brush, we had to use a large dump truck and three men to load it, and we were then faced with the problem of disposing of this brush, which was a job in itself.

Since purchasing the Fitchburg Chipper we only need one or two men and a pick-up truck to haul it, and we are not faced with the problem of disposing of this roadside brush, as the wood is now chipped along the roadside to form a soil-improving mulch.

Yours very truly,

J. E. Thier

Supervisor of Roads.

Free Booklet

Perhaps the savings in man hours and equipment mentioned by Mr. Thier in his letter may apply to your city, town or department.

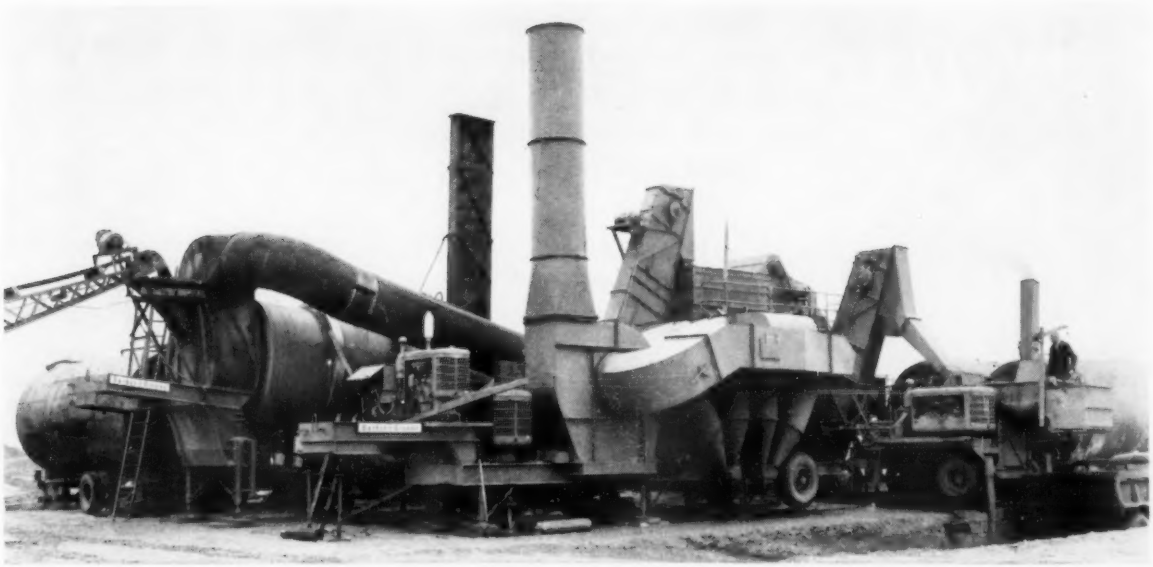
For further information on how a Fitchburg Chipper can benefit your operation, send for FREE BOOKLET: ***Fitchburg Chippers—Real "Brush Eaters".*** Address Dept. PW-56

FITCHBURG ENGINEERING CORPORATION
FITCHBURG, MASSACHUSETTS

laboratories and offices of both the Civil Engineering Department at Tech and the Materials Division of the Georgia State Highway Department. This arrangement exists in a number of states where joint highway research efforts are being carried on and it is very desirable, since staff members of both groups benefit by the close contact and mutual exchange of ideas. Another item was the announcement of the 1956 Student Job Training Program in Highway Engineering conducted by the Georgia Highway Contractors' Association and the Georgia State Highway Department for Tech students. Under the program, a selected student can spend three summers working in the highway field—one in engineering, one in contract construction, and one in an industry furnishing materials or equipment for construction work. The program is a marked success, with 45 students participating last year.

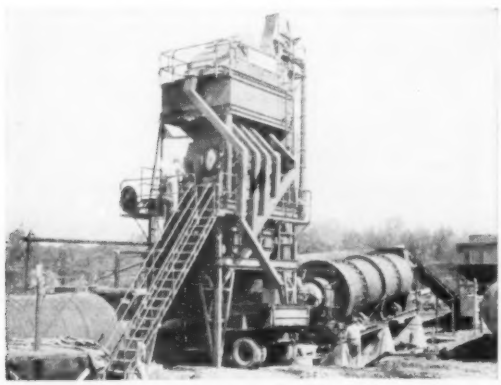
Soil Compaction by Vibration—Some general rules for the effective compaction of soils by vibration have been formulated by F. J. Converse, Professor of Soil Mechanics at the California Institute of Technology, who has done extensive research in this field. His suggestions include the following: For sands and other cohesionless soils — (1) compact at the resonant frequency of the soil mass (easily determined in the field) and (2) compact with the soil as dry as possible. With sands, excellent compaction is obtained at depths up to twice the width of the vibrator, or more, even with very low contact pressures. Compaction of cohesive soils by vibration is more difficult, but can be effectively achieved if (1) the vibrator is operated at the resonant frequency of the soil mass, (2) the dynamic force is approximately equal to the dead weight of the vibrator, (3) the moisture content of the soil is equal to or slightly greater than optimum moisture, and (4) the pressure on the soil is on the order of 10 to 12 psi.

Several types of vibrators are manufactured commercially. A typical plate-type vibrator is that produced by the Jay Corporation, Columbus, Ohio. One of their hand-operated, portable units (Model J-12) is designed for tamping materials around abutments, along walls, and in narrow trenches. This model has interchangeable tamping shoes of 12, 18, and 24-inch widths. In a recent test, one man using this machine compacted approximately 1400 cubic feet of fill against a retaining wall in 2½ hours. A large



How to lower the cost of asphalt paving

with Barber-Greene Continuous Plants . . . available in capacities from 20 to more than 200 tons per hour. Built for maximum portability, these plants produce all types of mixes at highest capacity, and for lowest operating cost. Once the proportions are set, operation is automatic; the human element is eliminated and manpower requirements are reduced to a minimum.



with Barber-Greene BatchOmatics . . . available in 2000, 4000 and 6000 pound sizes. Operating on inherently automatic principles, these plants save seconds at every point in the cycle. Instant change-over from automatic operation to manual production of mixes for the drive-in trade . . . instantly reset to preset repetitive cycle operation. New Dyna-Mix pugmill gives faster coating.

with the Barber-Greene Finisher. Having the widest choice of operating speeds, the Barber-Greene Finisher can lay every job at the maximum speed. It provides positive traction, superior maneuverability and unmatched ease of operation. Wide receiving-hopper simplifies truck discharge, eliminates spillage. No other machine paves as permanently, as speedily and as economically.

Write for literature on any plant in the cost-cutting line. Specify capacity. 56-25-AL

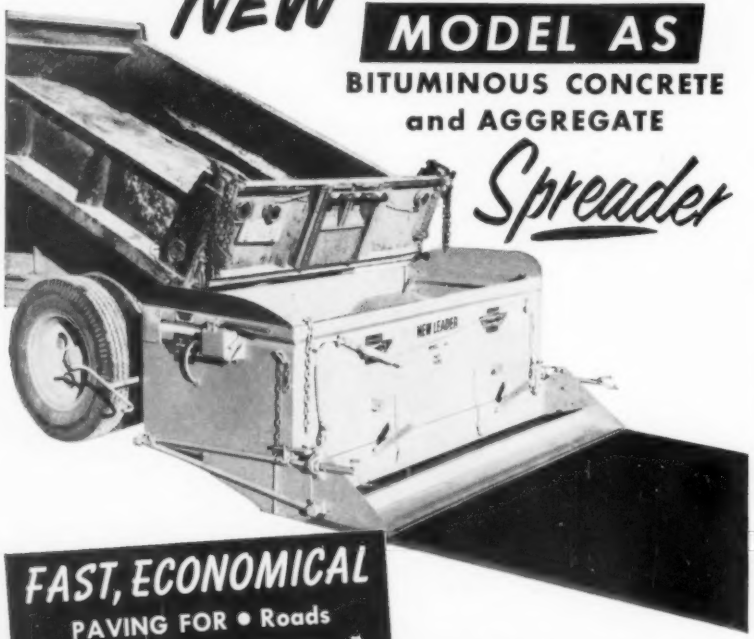
Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

Get full details of this month's products . . . mail your Reader's Service card today.

NEW 1956 NEW LEADER MODEL AS BITUMINOUS CONCRETE and AGGREGATE Spreader



FAST, ECONOMICAL PAVING FOR • Roads • Highways • Streets • Playgrounds • Airports • Driveways • Parking Lots

Handles Large or Small Paving Jobs with Equal Efficiency!

SEE FOR YOURSELF . . . COMPARE BEFORE YOU BUY! Insist on a spreader with *ALL* the features of the new 1956 Model AS Bituminous Concrete & Aggregate Spreader.

Enables contractors to make a good profit on jobs they previously turned down because larger machines or hand labor made the job unprofitable. Here is the only unit offering the exclusive economy features that will enable you to come out with a higher net profit on competitive bid jobs.

The new Model AS SAVES YOU MONEY

ON LABOR—does the job faster with less manpower.

ON MATERIAL—lays an accurate even mat over uneven base course.

ON TIME—eliminates expensive equipment and time in preparing base course.

Spreads Hot, semi-hot and cold asphaltic mixes and up to 4" base stone. Saves Labor, Material and Time.

Gentlemen . . .

Send Bulletin AS-645 on NEW LEADER Model AS Spreader to . . .

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TITLE_____

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CITY_____ STATE_____

HIGHWAY EQUIPMENT CO., Inc.
616 D Ave., N.W., Cedar Rapids, Iowa

MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF SPREADERS AND BULK MATERIAL DELIVERY EQUIPMENT

Thousands use our Readers' Service card to keep up to date . . . do you?

machine (model D-12) has a standard plate width of 25 inches and a special feature by which the exhaust gases from the engine heat a section of the plate when the machine is used for tamping hot asphalt paving patches. This unit has a vibration frequency of 1900 rpm and an impact blow of more than 1250 pounds; it moves forward under its own power at the rate of 22 to 30 feet per minute.

Short Course—Your writer had the opportunity recently of participating in a very good, intensive short course. That was the three-week "Traffic Engineering Seminar" held in March at the Traffic Institute of Northwestern University in Evanston, Illinois. This is an annual event, this year attended by 30 or so people from all sections of the country. Most of those enrolled were traffic engineers, actual or embryonic, and most of them from cities and towns.

During the three weeks, every phase of traffic engineering and closely related subjects is covered—some of them in considerable detail. Topics included traffic surveys, parking, accident analysis, traffic control, traffic signal systems, report writing, public speaking, city planning, highway and street capacity, and so on. Ramrod of the course is George W. Barton, who is a consulting traffic engineer in Evanston and also consultant to the Traffic Institute. Lectures were given by 20 or so different people, representing many areas of interest. This a real fine deal and we recommend it.

Just Wandering—In the big town (New York) motorists who honk their horns unnecessarily ("except as a warning of danger to human or animal life") now face $10 fines. The 1956 road program of Cook County, Illinois (Chicago) calls for the expenditure of $87 million; $78 million will be spent on badly needed expressway projects. The Ohio Department of Highways expects to spend over $200 million on construction during 1956. The American Association of Nurserymen (trees, not babies) has gotten into the act with a neat little booklet entitled "Deadly Motoring, or Planted Safety?" Did you know that some of our experts are now talking about a registration of 100 million vehicles in this country by 1965, instead of the 85 million estimate made a couple of years ago? A 16-mm. sound motion picture entitled "The WASHO Test Road" has been produced by the Bureau of Public Roads and is available on loan (running time, 35 minutes).

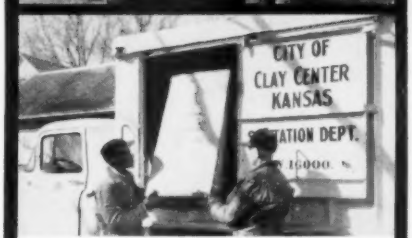
Here's Proof of MB Packer Superiority

one haul does it all!

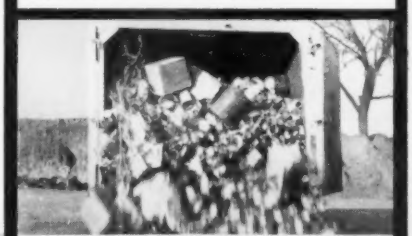
Look at the load in this M-B Packer Body! Springy evergreen branches, cardboard boxes, jumbo tin cans, wet garbage, gritty ashes, unwieldy branches — as tough an assortment of refuse you'll find anywhere! Only the M-B Packer Body with exclusive *progressive compaction* can load hard-to-pack material like this without pre-selection, double handling and call-backs.

Convenient side loading doors on both sides of the body are big enough for two collectors to work side-by-side. In alleys and other off-street locations four men can load at once. A powerful, roof-to-floor packing plate makes it easy to pack dozens of items that ordinary units can't touch. There's no need to baby your M-B Packer . . . it's engineered for long-life and rugged service with more blocks of collection from each route.

And you get added utility with the M-B Packer Body. Many cities and towns have found that the van-type design and flat, reinforced roof of the body make it the ideal unit for hauling park equipment, traffic markers, sand, snow, nursery stock, etc. Only with the M-B do you get this extra *bonus* feature!



NO ITEM TOO BULKY! City of Clay Center, Kansas finds the M-B Packer Body ideal for both commercial and residential pick up. This unit makes approximately 500 residential stops for refuse and garbage in a six hour period.



DUMPS FASTER! Smooth walls, floor and ceiling of the body make load ejection fast and easy. There's no need for expensive hydraulic dumping mechanisms—no "upending" of truck when dumping. And you get the added economy of a smaller truck chassis.

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DALLAS (1). . 1247 Praetorian Bldg.
SEATTLE . . . . . 550 Lane Street
SANTA CLARA, CAL., 649 Alviso Road
MADRID, SPAIN . . . Diego DeLeon, 60

Note how "Telvar" has kept the guard-rail area free of vegetation. Untreated section at left shows kind of growth involved, growth that causes fire hazards, cuts visibility and often impedes drainage.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada Limited, 80 Richmond Street West, Toronto, Canada.

Spray just once with Du Pont TELVAR®

WEED KILLERS

When you use "Telvar" weed killers, vegetation is killed through the roots and regrowth is prevented because the chemical remains in the soil . . . provides residual action all season long. And low dosages (1 to 1½ lbs. per 1,000 sq. ft.) make it cost little for the results you obtain. Such low rates also mean less handling, less use of storage facilities.

"Telvar" weed killers come as wettable powders, are non-corrosive, non-flammable, non-volatile, low in toxicity to humans and livestock.

Include "Telvar" weed killers in your weed-control program this year. Prove to yourself how these products of Du Pont research can help cut your maintenance cost to new low levels.

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Where brush is a problem, Du Pont Ammate® X weed and brush killer is the product you need. It kills more kinds of brush with unusual safety. With ordinary precautions, "Ammate" X may be used close to such crops as cotton, tomatoes, soybeans and peanuts.

On all chemicals, follow label instructions and warnings carefully.

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WEED and BRUSH KILLERS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Westinghouse fluorescent luminaires' exclusive features speed installation and maintenance

Get full details of this month's products . . . mail your Reader's Service card today.

Look what's new in Cleveland! A great white way of fluorescent light by Westinghouse 4FSL-72 street lighting luminaires. The change from the old system to the new was made in record time because Westinghouse units are designed for quick installation and simple maintenance. The importance of these advantages can be measured in real savings—savings in labor cost during installation and for the maintenance life of your street lighting system.

If you are planning a fluorescent street lighting program, examine these important features, and you will agree that the Westinghouse 4FSL-72 fluorescent luminaire is built for a lifetime of efficient, economical operation.

More information? See your nearby Westinghouse representative, or write Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio. J-04390

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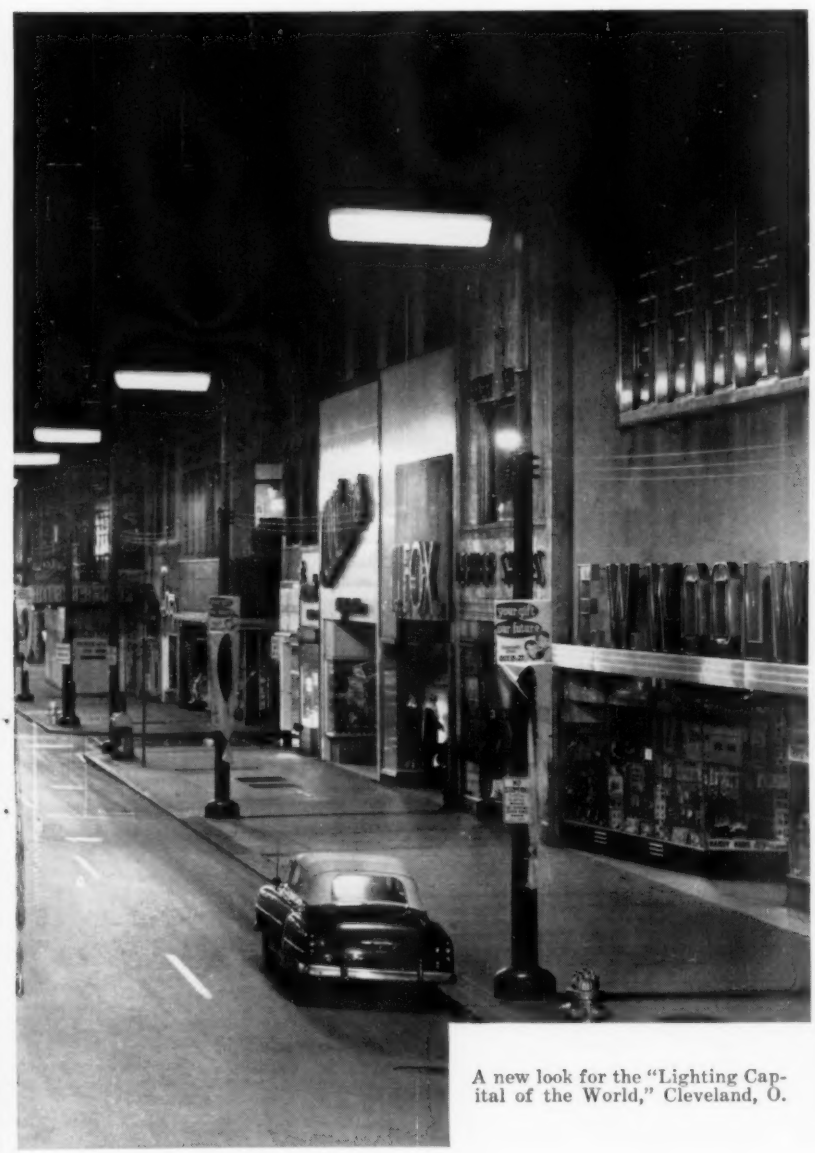
where **BIG** *things are happening for* **YOU**



A new look for the "Lighting Capital of the World," Cleveland, O.

Attaching luminaire to pole . . . is done by tightening four bolts on the heavy-duty mounting bracket. 4FSL-72 may be mounted horizontally or at a 15°-30° angle for wider light distribution.

Connecting wiring . . . three knurled nuts are loosened *without tools*, allowing reflector to hinge down for easy access to ballast and wiring. Wire is brought through watertight bushing; leads are then attached to terminal block.

Closing luminaire after installation . . . cover may be opened or closed from either side by releasing three pressure latches. Cover is clear acrylic plastic which will not discolor with age. Fiber glass housing *never* requires painting.

Thousands use our Readers' Service card to keep up to date . . . do you?

MEMO to Engineers and Contractors . . .

Here are some of the typical advantages Transite Sewer Pipe gives you.

In planning and designing a system

- **high flow capacity** ("n" = 0.010)—permits use of flatter grades or smaller diameter pipe.
- **long life** — corrosion-resistant—durable.
- **tight joints**—cuts infiltration, roots penetration and exfiltration.
- **resilient joints** — absorbs vibration and shock—minimizes effect of earth movement.
- **"all-Transite" line** — Transite Sewer Fittings with Ring-Tite assembly—(plus Transite Building Sewer Pipe).
- **strength** — tough — high crushing strength meets design requirements.

In installing a system

- **light weight**—economical to handle, truck, and lower into trench.
- **long lengths** — easy to line and grade — fewer joints to make — smaller installation crew.
- **packaged joint** — assembly fast, simple, sure . . . even under difficult conditions — no compounds and related equipment.
- **easy-to-assemble fittings** — also with speedy Ring-Tite assembly — no compounds or equipment — all Transite.
- **easily made branch connections, too** — holes for cut-ins quickly done right on job.

Select TRANSITE® for more economical, tighter sewerage systems . . .

Whether a new sewerage system is being planned or additions to an existing one are being made . . . engineer and contractor alike will find a combination of qualities in performance-proved Transite Sewer Pipe that will fit their individual needs. They will find this holds true whether the local conditions call for (a) tight joints to protect against root growth and infiltration of ground water or (b) the strength and flow characteristics that mean definite savings in the design stage, during trenching and installation, and in operation as well.

For further information about Transite Sewer Pipe, write for Booklet TR-165A, Johns-Manville, Box 60, New York 16, N.Y.

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with the RING-TITE® Coupling

Now's the time to mail this month's Readers' Service Card.

Atomic City's 350,000 Square Foot Shopping Center

Lighted by

KERRIGAN

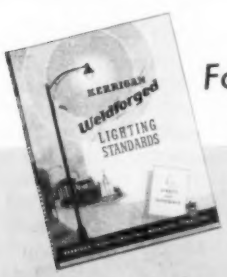
Weldforged

STANDARDS

Partial views of one of the South's largest shopping centers in Oak Ridge, Tenn.

The parking area of this large and impressive new shopping center in downtown Oak Ridge, Tennessee is lighted by sixty Kerrigan Weldforged, continuous tapered, octagon shaped, low allow steel standards measuring 31 feet, 3 inches and mounted on 18-inch concrete pedestals for a total height of 32 feet, 9 inches. Poles are spaced at 141 feet north and south, and 133 east and west. The parking area alone cost $92,000.00 and has 9-foot spaces for over 2,000 automobiles. A wide crusing lane circles the parking area with pick-up stations at super markets, department stores and variety stores.

Kerrigan lighting standards are now found in cities all over the country—in parks and parking centers, on streets, highways and bridges—wherever there is a need for modern lighting. Made from J&L's low-alloy, corrosion resistant steel, Kerrigan Weldforged standards weather both the elements and the years. Write now for catalog.



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SHAWNEE "SCOUT" BACKHOE
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SHAWNEE OFFERS
MORE FEATURES
FOR LESS MONEY

Exclusive, patented drag line principle produces digging force of approximately 6,000 lbs. at bucket teeth.
Patent Numbers: 2,669,367 and 2,682,346

6-bank, free-flowing valve system—can operate 2 or more at once.

Bucket widths—12" to 24" inclusive. Flat bottom buckets 32" and 36"

DIGS 12 FT. DEEP — LOADS 8½ FT. HIGH

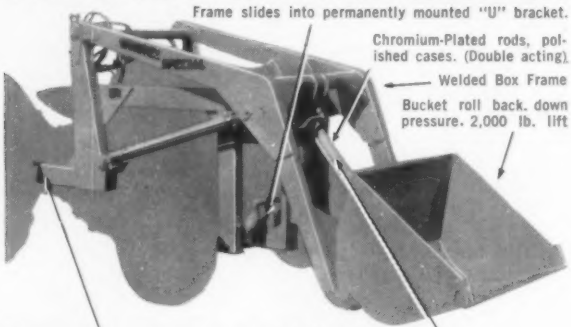
FOR ALL POPULAR MAKE TRACTORS

NEW INDIVIDUALLY CONTROLLED HYDRAULIC STABALIZERS

Now designed with hydraulic "feet" for quick leveling-up to dig plumb holes, new D-70-HL is ready for work **seconds** after the tractor stops rolling. Working on slopes or with one wheel on a curbing makes no difference. Recommended for mounting with the Shawnee "Special" front end loader.

SHAWNEE "SPECIAL" LOADER

Frame slides into permanently mounted "U" bracket.
Chromium-Plated rods, polished cases. (Double acting)
Welded Box Frame
Bucket roll back, down pressure, 2,000 lb. lift



To remove loader, remove frame pins, hoist loader forward and up, then drive tractor away. Takes less than five minutes.
Single or twin bucket cylinders optional.

Perfect team-mate for the new D-70-HL, the "Special" Loader provides a balanced unit regardless of which tool is being used. It has tremendous lifting power—dumps well ahead of the front of the tractor and has powerful down pressure to bite into tough materials.

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FOR USE ON ALL
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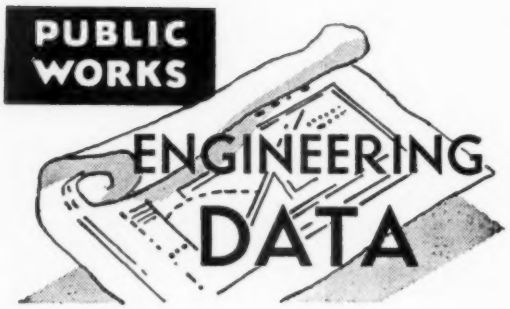


Report on Water Supply for Westchester County, New York

This material is part of the Preliminary Report on the Water Supply Problem of Westchester County, New York. It was prepared by Simon P. Carman, Consulting Engineer, for the Westchester County Water Agency, White Plains, N. Y., of which George J. Natt is Director.

Water supply requirements are based on per capita rates of water consumption which must be established in order to arrive at an overall estimate of future water supply needs. The first of the items to be considered in this category is that of household consumption. A spot check of family requirements reveals that the average consumption of water in Westchester communities varies from 40 to 100 gallons per capita per day. During the summer months the average daily consumption can be conservatively estimated at from 50 to 130 gallons per capita. Peak hourly domestic requirements can be expected to be twice or even three times this hourly rate.

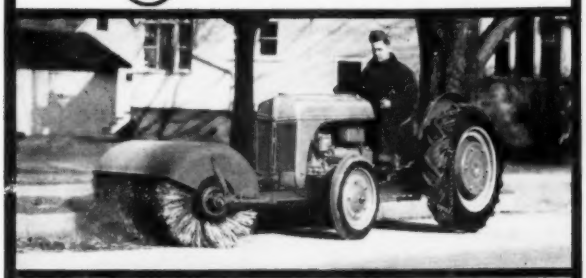
Lawns and Gardens Use Water

The cultivation of lawns, shrubbery and flower gardens is an important aspect of the suburban way of life. In the not too distant future, provision of water for the furtherance of this activity will constitute an essential domestic need. For the present, control of lawn sprinkling operations during evening hours will do much to relieve the peak loads on the distribution, pumping and storage elements of the water supply systems, reducing the impact of this type of load. While the amount of water used for this purpose on an average per capita per day basis is relatively small, the use results in peak loads of great magnitude. Distribution and storage facilities must be evaluated in terms of this growing demand for this type of use.

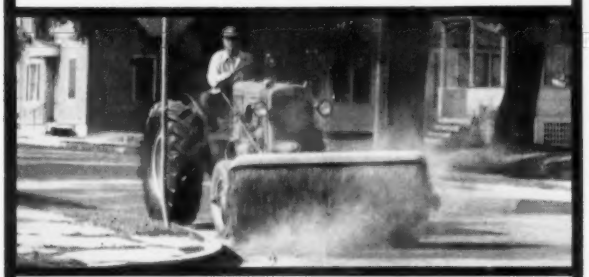
Coupled with the domestic requirements are those which concern commercial, industrial and general municipal uses.

Many commercial and industrial users have their own supplies for all or a portion of their needs. However, in some communities, the quantity of water supplied to industries from the community water supply system is very large. A new category of water use which has come into prominence within the past few years has been the supplying of air-conditioning units. Water in relatively large amounts is used in the larger units. To date, the conditioners used in homes have not placed any considerable demand on water supply facilities. Inasmuch as the large units can be installed with devices permitting the reuse of a large portion of the cooling water, it is desirable

Sweepers



clean streets faster



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the year 'round

M-B Sweepers know no season. They keep your tractors busy every month of the year . . . spring cleaning streets and sidewalks; assuring good housekeeping in summer; keeping streets and roads clear of leaves in fall; and sweeping winter's snow from thoroughfares and skating rinks. Here is a truly versatile year 'round tool.

COMPARE THESE OUTSTANDING ADVANTAGES!

- 30° Sweeping Angle
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Write today for full information.

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16 MILLION GALLONS OF WATER PER DAY, even in extremely dry periods

Says
Mr. R. E. Cannard
Manager, City of Manitowoc
Public Utilities

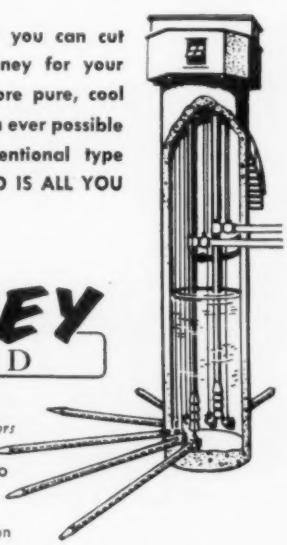
the RANNEY METHOD a "MUST" for the CITY OF MANITOWOC, WISCONSIN

Collector "A" at the Power Plant, City of Manitowoc

Mr. Cannard says, "We have found the RANNEY to be far more efficient than the conventional type wells. Our RANNEY collectors require less personnel, fewer pumps, cuts operating costs, and eliminates filter stations altogether. The RANNEY METHOD has solved our water problems and the collectors are just as good today as they were when they were installed ten years ago."

FOR YOUR CITY TOO

Write now, and learn how you can cut unnecessary costs, save money for your community, and produce more pure, cool water from just one well than ever possible before, with multiple conventional type wells. THE RANNEY METHOD IS ALL YOU NEED.



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with built-in folding tray...

all one unit, no loose parts, easy to set up or fold up for carrying . . . and tray makes it rigid as a stubborn mule!

Vise overhangs front legs so threader handles swing clear . . . Extra light, strong . . . Big vise base, pipe and conduit benders, pipe rest, tool slots, ceiling brace screw . . . efficient vise with LonGrip jaws—it's got everything!

See and try 40A Tristand, ⅛" to 2½", at your Supply House!

"Threaded Pipe—It's Tight—It's Best—Costs Less"

RIDGID Work-Saver Pipe Tools

The Ridge Tool Company Elyria, Ohio, U.S.A.

that water works systems initiate codes and regulations which will limit the amount of water supplied to this type of facility. Such codes and regulations are now in existence in some Westchester County communities.

Included in the general municipal use category are fire protection, institutional, recreational and similar uses by facilities under the control of governmental agencies. An allowance for the leakage within the system itself is also included in this category.

As regards recreational uses, there are in Westchester County a large number of golf courses and park areas. The maintenance of these at their most desirable levels requires the use of considerable amounts of water. In some cases, these facilities have their own water supply systems. However, in some communities the use of water by them constitutes a heavy draft on the municipal supply system, particularly the storage and distribution portions of the systems.

Uses coming within the municipal or institutional category, including leakage, vary widely from community to community. Their requirements frequently equal and often exceed those necessary to meet domestic needs.

Estimating Future Rates of Water Consumption

The estimation of future rates of water consumption is, as in the case of population predication, a matter of conjecture. But this we do know: The rates of use are increasing steadily. Studies made by the New York City Board of Water Supply indicate that the rate of increase can be expected to be slightly less than ¾ of a gallon per capita per day per year. This estimate of the rate of increase includes all uses, domestic, municipal, industrial and commercial.

Studies further indicate that for nine of the largest cities in this country, an average rate of increase of ½ gallon per capita per day per year is not unlikely. For the next two decades a rate of increase of approximately one gallon per capita per day per year has been used in this report. For the last quarter of the century an increase of slightly more than ½ gallon per capita per day per year has been recorded.

There exist water supply sources of sufficient size to insure, for the remainder of this century, the overall needs of Weschester County. The problem which the various communities face is one of using these supply sources in such a manner as will secure to the consumer a completely adequate water supply service.

In this connection, the need for intercommunity participation in the developing of beneficial programs is important. It is hoped that in a short time some of the needed improvements to the individual water supply systems can be developed through application of the principal of joint community action among the water supply systems involved.

The Water Agency will assist communities in the planning of their future water supply systems so that they can keep abreast of the demands which will be placed upon them in the future. It wants to perform this function without infringing on the prerogatives of home rule or getting into the water supply business as such. In the study, the Water Agency has had the wholehearted cooperation of all the individuals concerned with the many water supply systems in the County: the various agencies of the County; the water department officials of New York City; the State Department of Health; and many others.

F.M.D. Tractor-Loader handles up to ⅝-yard loads, priced hundreds of dollars less than other diesel rigs

F.M.D. Tractor and Digger cuts costs of laterals, footings, service lines. Fast, positive hydraulic control. Fordson Major Diesel equipped with both rear-mounted backhoe and front-mounted loader makes an efficient, low-cost unit for excavating, loading, backfilling.

The powerful Fordson Major Diesel and new "Step-On" Loader handle production loading at lowest cost. See for yourself!

Check workability—One easy step puts the operator into the seat, ready to work, fast. At his command are scientifically placed levers for instant hydraulic control of ⅝-yard or ½-yard heavy-duty buckets. A touch of a lever and double-acting cylinders on lift arms and bucket deliver positive down pressure . . . over two tons of breakaway power . . . 2000 lbs. load capacity at full lift. Tilt back crowds maximum loads into the bucket. There's less spillage on the haul . . . parallel linkage of lift arms keeps bucket level, makes loader adaptable for fork lift work. For faster, more efficient truck loading, there's ample lift and reach to work from one side and still distribute loads evenly in high-bodied trucks.

Check price—You'll find the F.M.D. Tractor-Loader priced hundreds of dollars less than other diesels with comparable power and equipment. You also save on operating and maintenance costs. To get the complete story on this low-cost production loading team, call your Ford Tractor and Equipment Dealer, or write to the address below.

TRACTOR AND IMPLEMENT DIVISION
FORD MOTOR COMPANY
Birmingham, Michigan

Now's the time to mail this month's Readers' Service card.

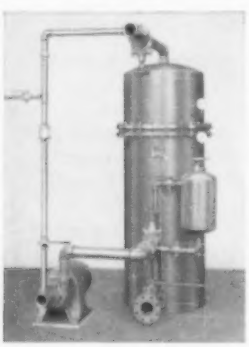
Beautiful Silver Thatch Inn, on Pompano Beach, Florida, offers its guests this lovely pool with underwater picture windows.

YES, here's another distinctive pool with the popular Adams Poro-Stone filters. More and more public pools are insisting on Adams Filters, and there are many good reasons why. Here are two of the important ones.

First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements. The high air dome and unrestricted backwash outlet provide complete purging of the filter tubes with high velocity water.

Second, rugged 4¼" O.D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter — in use since 1938 — was the first Poro-Stone Swimming Pool Filter installed in this country.

There are numerous other reasons why it pays to specify and buy Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the Handy coupon below.



R. P. ADAMS CO., INC.
228 East Park Drive
Buffalo 17, N. Y.

This Adams SPF-129 Poro-Stone Filter keeps the Silver Thatch Inn pool water brilliantly polished for the enjoyment of swimmers and viewers alike. It offers 129 square feet of filter area . . . will handle pools up to 185,000 gallons capacity. It is ideally suited for outdoor pools such as is shown above.

R. P. ADAMS COMPANY, INC. MA-56
228 EAST PARK DRIVE, BUFFALO 17, N. Y.

Please send me by return mail your new Bulletin 625.

Name.....Title.....
Business.....
Street.....
City.....State.....
Size of pool is.....gallons.

Utilities, Cities and Counties Urged to Join Mapping Programs

In a paper before the ASCE Dallas, Tex., meeting, Everett D. Morse, Superintendent of Civil Engineering, Houston Lighting & Power Co., urged that utility companies join with city and county governments in sponsoring a cooperative arrangement with the Coast and Geodetic Survey. By doing this, the density of the triangulation control could be increased greatly at a nominal cost to each participant. With this accomplished, the interested parties would be in a position to obtain accurate and large scale planimetric maps at a relatively low cost through photogrammetric methods by employing an aerial mapping company.

Municipal Employee Salaries in Ohio

Listed below are municipal employee salary schedules for 1955 of various cities in the State of Ohio as abstracted from *The Ohio Municipal League*. Note that the salaries decrease as the population of the cities decrease.

		City Engineer	Supt. of Water	Supt. Sewage Disposal
Cleveland	(914,000)	$10,824	$10,200	$9,348
Columbus	(376,000)	9,340	9,348	6,012
Dayton	(244,000)	9,061	7,891	7,891
Canton	(117,000)	7,208	6,890	6,890
Hamilton	(58,000)	8,100	8,100	
Lima	(50,000)	7,200	7,200	4,320
Portsmouth	(37,000)	7,500	7,000	
Cuyahoga Falls	(29,000)	8,160	5,640	5,640
Lancaster	(24,000)	5,400	4,800	4,500
Piqua	(17,000)	7,380	5,220	5,220
Painesville	(14,000)	7,200	5,544	5,544
Ravenna	(9,900)	6,000	5,100	5,100
Orrville	(5,100)	5,418	5,976	3,753

Repairing Utility Street Cuts Promptly

In the course of a survey and study by Griffenhagen & Associates in Milwaukee, Wisc., recommendations by the Superintendent of Street Construction resulted in adoption of a policy whereby ulitity companies are required to surface their own street cuts with a permanent type patch within 48 hours of the time the cut is backfilled. Previously the utilities had used screenings and the city had placed the permanent patch later. The new arrangement releases city labor and equipment, with less interruptions, for general street maintenance.

2440 lbs. of Debris per 1000 ft. of Sewer

There were 44,008 lin. ft. of storm and sanitary sewers cleaned in Cuyahoga Falls, Ohio, from January 1, 1955, to November 30, 1955. From this length of sewers there was removed 53.69 tons of debris. There are 135.833 total miles of streets with 69.170 miles of paved streets within the city. During 1955 the city awarded approximately $185,100 in street paving contracts. This information is from the excellent annual Engineering Report of the Office of City Engineer, Cuyahoga Falls, Ohio, T. H. Sauter, City Engineer.

Texas Highway Signs and Markers

According to *Texas Highways*, the State Highway Department uses 272,393 signs and markers on its highway system. There are also 1771 highway and railroad crossings at grade, 478 railroad and highway separations and 221 highway grade separations.

BIG TREES *From Little* ACORNS

MH

From a small beginning some 35 years ago, M & H Valve and Fittings Company has steadily grown to become a foremost producer in the valve and hydrant industry. M & H products today are widely used for water distribution and fire protection services in all sections of the United States and many other parts of the world.

This M & H leadership is no accident. It is due to the cooperation of a loyal M & H organization, working with experience, skill and a great enthusiasm, to consistently design and produce valves and hydrants of recognized superiority. Catalog 52 sent upon request.

M&H VALVE AND FITTINGS COMPANY
Anniston, Alabama

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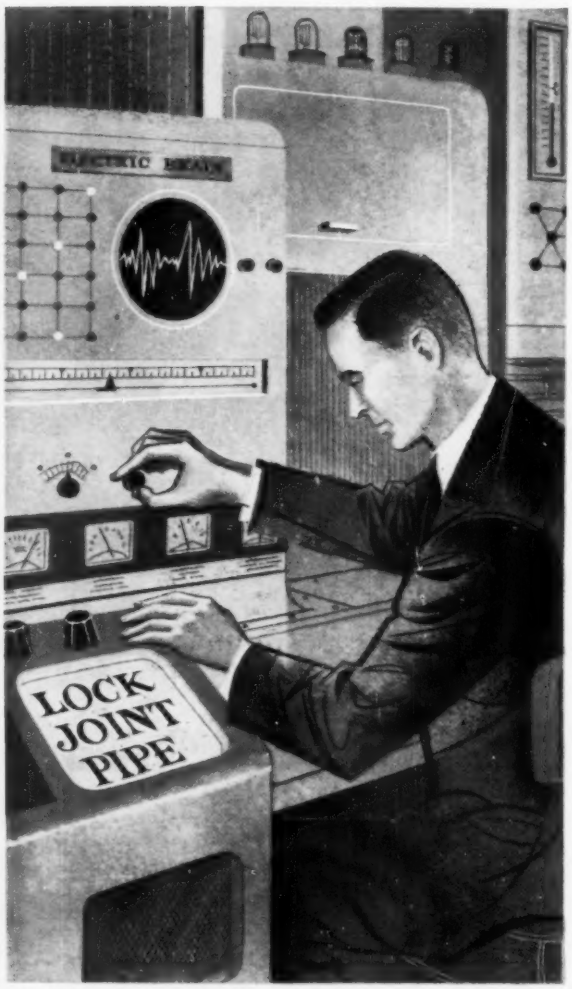

NO MATTER HOW YOU FIGURE IT...

When you undertake the purchase of a new pipeline for your water supply system, do you figure from the financial angle—low first cost, economical installation and a long life for your investment?

Or are you more interested in the construction of the line—minimum excavation, easy assembly, and watertight joints in a pipe strong enough to withstand high pressures and heavy external loads?

Then, again, your specialty may be maintenance. In that case you probably figure minimum repairs through freedom from breaks and leaks to be of paramount importance.

Or is your main concern with operation? If so, you no doubt figure permanent high carrying capacity, low pumping costs and trouble-free service to be vital.

Still, *no matter how you figure it*, your best answer will always be LOCK JOINT CONCRETE PRESSURE PIPE, because it most nearly approximates the ideal pressure pipe for water works systems.

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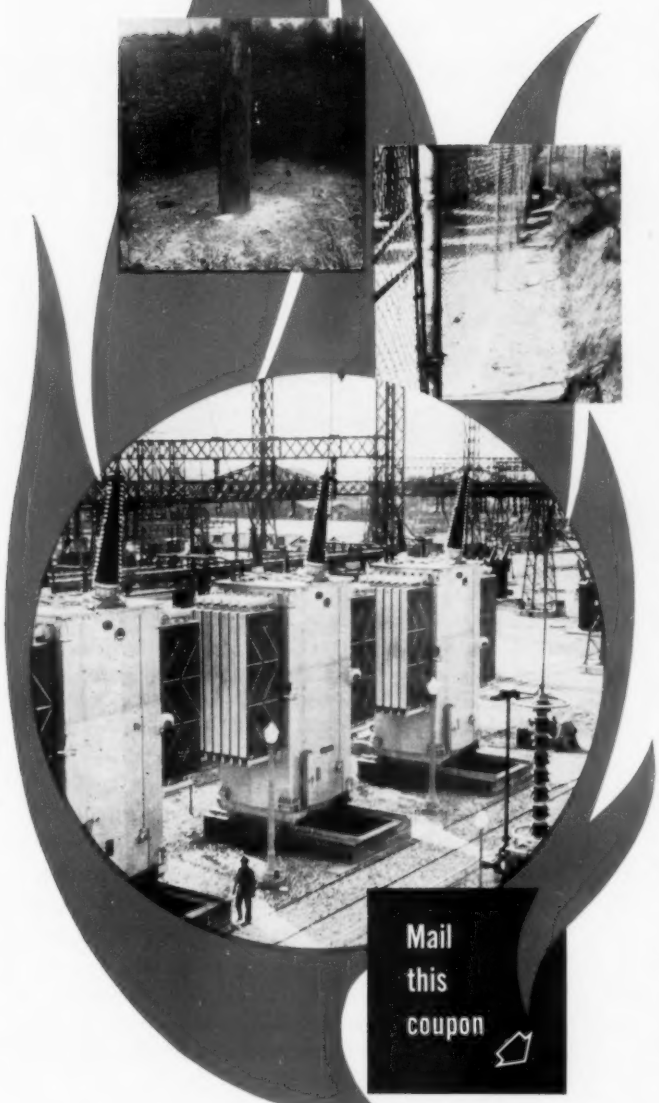
PROTECT YOUR PROPERTY AGAINST GRASS FIRES!

here are two good ways to destroy fire-hazardous weeds and grasses...



You have a choice of either spraying, or applying a granular weed killer which goes on dry. By either method you can destroy weeds and grasses *and prevent regrowth* for as long as two years! Choose one of these two popular soil sterilants for keeping *your* grounds free of unsightly and hazardous weeds.

CONCENTRATED BORASCU® WEED KILLER

For DRY application in the simplest way... without special equipment. There is nothing to mix and no water to haul. This borate ore in granular form can be applied by just a man with a pail. It is safe to handle; does not corrode ferrous metals; is toxic to all forms of vegetation; gives lasting control.

POLYBOR-CHLORATE®

Apply this weed killer as a spray, or dry. Spraying gives quick knockdown to tall standing vegetation... kills topgrowth... attacks roots. Remains in soil to prevent regrowth for as long as two years. Although this herbicide is a combination of sodium borates and sodium chlorate, it is nonflammable and nonpoisonous when used as directed.

√ Check these features:

- **EASY TO APPLY... AND SAFE**
- **RESULTS ARE LONG-LASTING**
- **NONSELECTIVE • NONPOISONOUS**
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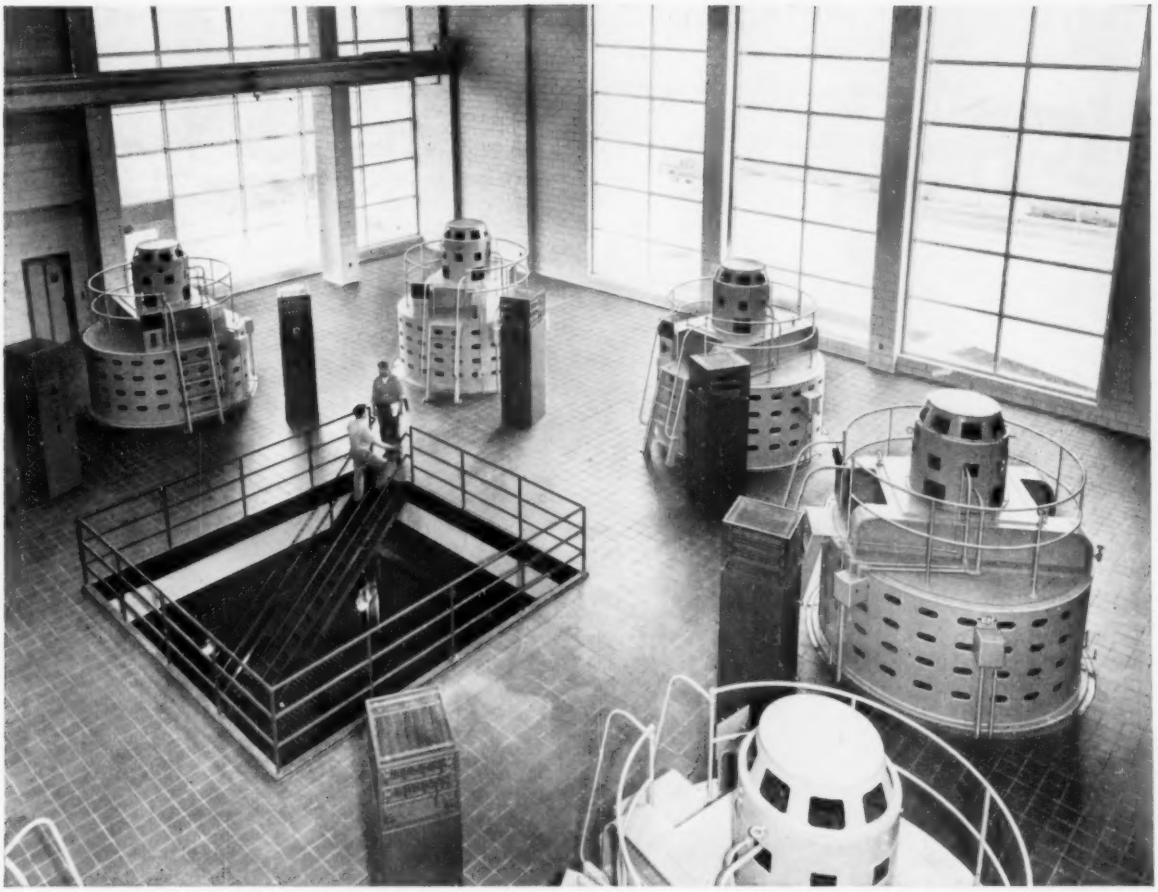

Here's how Detroit got flood-busting pump power for Storm Water Sewer System

Extensive rainstorm flood damage had been a problem that 150,000 residents of the Fox Creek District of Detroit faced each year. Existing storm sewers and pumping stations were recognized as being inadequate.

To end this situation, Detroit city engineers started a long-range area program. It included the installation of a new large storm water sewer system backed up by a series of pumping stations capable of pumping an enormous quantity of water, *fast!*

Will Handle 30,000 Gallons a Second

The Freud Storm Water Pumping Station shown above is the third to be completed in the new system. Eventually this station will handle up to 30,000 gallons per second with the eight huge pumps installed there.

Eight rugged E-M Vertical Synchronous Motors and Controls are used to drive these huge pumps. Each motor develops 3000 horsepower at 225 rpm.

Here's why E-M Vertical Synchronous Motors were chosen:

1. **HIGH EFFICIENCY** conversion of electric power to mechanical power by synchronous motors . . . results in minimum electric power cost operation.
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4. **ACCESSIBILITY** thru sectional frame design and convenient inspection openings . . . keeps disassembly and inspection costs at a minimum.
5. **SIMPLE STARTING** with "Conscious" Control by the E-M developed Polarized Field-Frequency Relay System.

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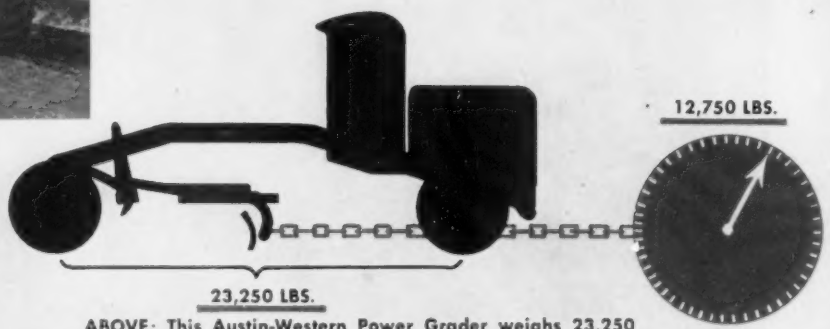
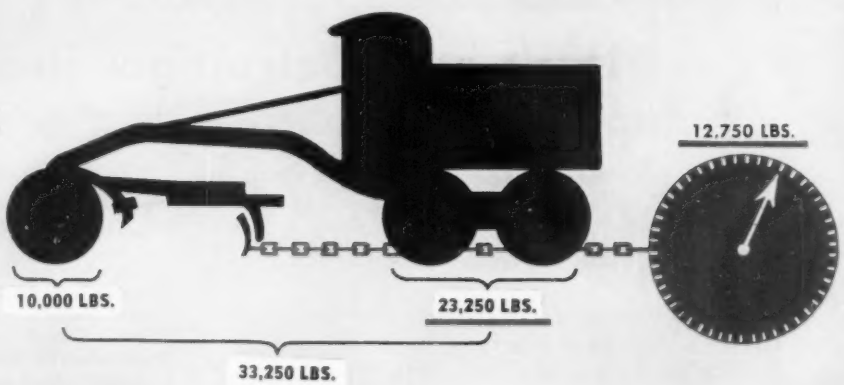
Most for Your Money

From every standpoint . . . first cost, operating cost and upkeep . . . the A-W Power Grader gives you more for your money . . . moves 30 percent more material than an ordinary grader of equal weight and horsepower; and as much material as heavier, more expensive graders . . . as explained in the diagrams at the right.



ABOVE: This Austin-Western Power Grader weighs 23,250 lbs.—all carried on driving wheels. Working in average dirt, it has a blade pull of 12,750 lbs.

BELOW: To obtain the same blade pull, an ordinary motor grader would have to carry 23,250 lbs. on its *rear drivers;* PLUS about 10,000 lbs. on its *dead front end,* for a total of 33,250 lbs.



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There's more to the story. All-Wheel Steer . . . another exclusive Austin-Western feature . . . makes the machine twice as maneuverable as graders with front steer only; while the Controlled Traction made possible by the teamwork of All-Wheel Drive and All-Wheel Steer moves more material . . . moves it farther . . . moves it faster. Your nearby Austin-Western distributor will be glad to tell you the whole story of "The Power Graders That Have Everything."

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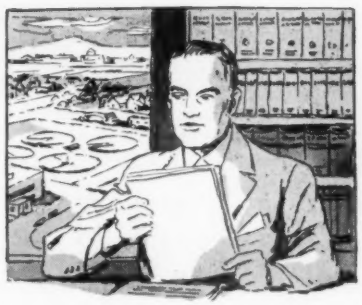

MELVIN NORD,
Dr. Eng. Sci., LL. B.
Registered Professional Engineer

Dedication

On July 10, 1909, the owner of certain land filed a plat of Mackin's First Addition to the Village of Maxwell. The addition consisted of 4 blocks in a rectangular plat. The plat shows streets around each block with alleys through each block. It is recited that the streets and alleys "are dedicated to the Public use."

A portion of these streets has never been graded or maintained as a street. It is unused and unimproved so far as public travel is concerned, and still in its natural state.

In 1932, the Village of Maxwell by ordinance granted a telephone company the right to construct and maintain an interstate line over the streets and highways of the village. Such a line was constructed on the "street" in question.

In 1951, a drainage ditch was constructed along the "street" in question, at the instance of the present owner of the land, Booth, with the express consent of the village. The contractor who dug the ditch took the dirt in payment.

In 1953, Booth began the construction of a garage in the "street" in question, and completed it over the protest of the Village. It is also found now that the west wall of Booth's house and the eaves are in the "street", and that he has built a fence across the "alley".

The Village then filed a petition asserting ownership and right of possession of the "street". A few months later, the Board of Trustees of the Village passed a resolution to open the "street" in question. A few days later, Booth executed, acknowledged, and filed a vacation deed, "vacating a strip of land 80 feet in width located to the west of lots 5 & 6 in Block 4." Booth's defense to the action filed by the Village was based largely on the "vacation deed".

In the case, *Village of Maxwell v. Booth*, 73 N.W. (2d) 177, decided in the Supreme Court of Nebraska on Nov. 25, 1955, the court held as follows: The plat is a mere offer to dedicate, which must be accepted before the dedication becomes complete. It is not necessary that a municipality accept and open a street for public use, in order for this acceptance to occur. Any positive conduct of the proper public officers evincing their consent on behalf of the public may amount to acceptance. Granting rights to the telephone company was an acceptance, and so was the actual use of streets for the telephone lines. Approval by the Village of the construction of the drainage ditch also evidenced acceptance of the dedication. Protest by the Board of Trustees to the erection of a garage by Booth was also evidence of an acceptance of the dedication, and so was their passing a resolution to open the street. Thus, it is clear that the dedication was accepted by the village.

As to the "vacation deed", the court held that Booth had no power to withdraw the dedication after it had been accepted.

Eminent Domain

When the state or a state agency takes property for a public use under its eminent domain power, it must of course pay reasonable compensation for it. A question which frequently arises is whether real estate taxes on the property should be deducted from the award. The general rule as to this is quite simple: if the taxes were due *before* the condemnation occurred, the state can deduct them from the award (assuming they have not yet been paid); but if the taxes become due only *after* the condemna-

FAST, LOW-COST WAY TO INSTALL PIPE . . .

push it under streets, roads, tracks, lawns with a timesaving

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Speed underground piping jobs this way. GREENLEE Pusher is one-man-operated (by hand or with power pump), portable, simple to set up and use. No tearing up of pavement, floors, lawns . . . does away with extensive ditching, tunneling, backfilling, repaving. GREENLEE Pusher cuts job time to a fraction . . . often pays for itself on first job.

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GREENLEE Pushers are available in two sizes: No. 790 for ¾" to 4" pipe . . . No. 795 for pipe over 4", concrete sewer pipe, large ducts. Average performance of No. 790, shown above with power pump, two feet per minute. Write for literature.

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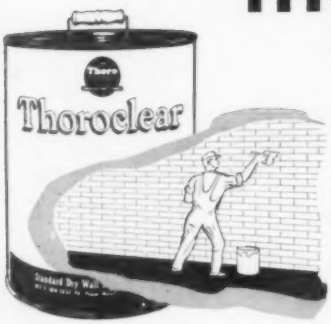

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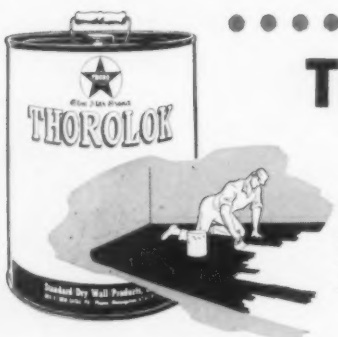

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tion has occurred, then they cannot be deducted from the award. (In a few cases, prorating the tax, on the basis of the fraction of the year the owner had the land before condemnation, has been permitted.)

In Chicago Park District v. Douney Coal Co., 1 Ill. (2d) 54; 115 N.E. (2d) 223, decided Sept. 24, 1953, a petition for condemnation was filed on May 11, 1951, and a judgment awarding compensation of $70,000 was entered on May 16, 1952, and the amount was deposited in court. Tax day was April 1, 1952. When the Coal Co. sought payment of the award, $3500 was deducted for real-estate taxes due on April 1, 1952.

On the basis of the rule cited above, it would seem that the tax was properly deducted, since title did not pass until May 16, 1952, a month and a half after tax day. Nevertheless, the court held the contrary, i.e. that no deduction for the tax was permissible.

In explanation, the court held that although the title did not vest in the condemnor until the deposit of the award, the title "related back" to the date of filing of the condemnation petition.

There appears to be no unanimity of opinion on this point from state to state. Courts have held either way, i.e. that condemnation "occurs" when the title passes, or that it "relates back" to the filing of the petition. In addition, some courts have held that condemnation "occurs" when the condemnor takes possession of the property pending the outcome of the condemnation proceedings.

Statutes and judicial decisions vary on this point from state to state, and it is therefore necessary to be cautious in predicting what the rule is in any state. Cases are collected in 45 A.L.R. (2d) 518.

• • •

Sewer Leakage Tests in Florida

Leakage tests for sewers are covered in the Florida State Board of Health policy statement for the design of sewer systems and treatment plants, as follows: Leakage tests should be specified and the leakage outward with the trench dry, or the infiltration in the case of wet trenches, should not be allowed to exceed 10,000 gallons per mile per day for any size of sewer up to 15-in. For pressure pipe sewers, the leakage allowance should not exceed the rate of 200 gals. per inch diameter per mile per day under appropriate test head.

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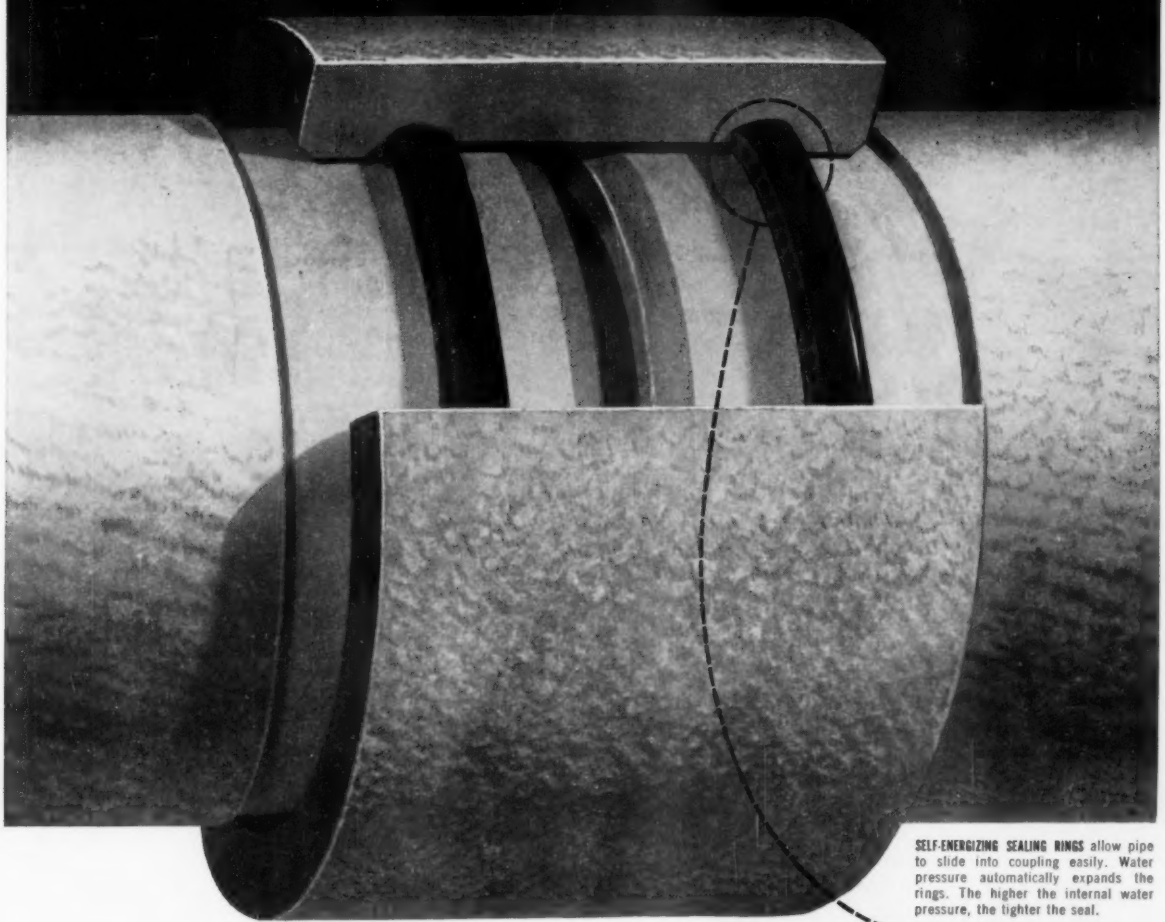
"FLUID-TITE"® COUPLING*

For "Century®" Asbestos-Cement Pressure Pipe



SELF-ENERGIZING SEALING RINGS allow pipe to slide into coupling easily. Water pressure automatically expands the rings. The higher the internal water pressure, the tighter the seal.

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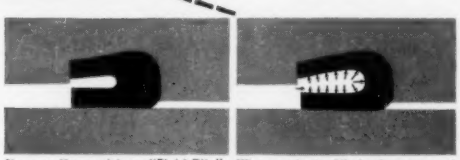
Now, using the new "Fluid-Tite" Coupling, crews can lay more "Century" Asbestos-Cement Pressure Pipe per hour than ever before. No cumbersome coupling pullers are needed. "Century" Pipe can be easily connected with standard valves, hydrants and fittings.

Thanks to the speed and simplicity of using "Fluid-Tite" Couplings, there is no need to hold up pipe-laying operations in rain, snow or wet trench conditions. Specify "Fluid-Tite" Couplings with "Century" Asbestos-Cement Pressure Pipe. You'll get more rapid installation, plus full flow and low maintenance. Write today for details.

"Century" Pipe and "Fluid-Tite" Couplings meet A.W.W.A., A.S.T.M., and Federal specifications and are approved by Underwriters' Laboratories, Inc.



New self-energizing "Fluid-Tite" sealing rings have tapered surfaces, and compress, to permit pipe to slide in easily.

When main is filled, rings expand with application of internal water pressure, creating a tighter seal.

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filter performance with PALMER FILTER BED AGITATORS

The Palmer Filter Bed Agitator is a simple and inexpensive device that is being incorporated in new and existing plants to increase the filtration capacity and eliminate mud balls.

TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
- 8—More water through the filters
- 9—Less "time out" washing filters

The Palmer Filter Bed Agitator is covered by U. S. Patents 2309166 and 2309017.

ENGINEERING FACTS

CONSTRUCTION—The Palmer Filter Bed Agitator is constructed of brass and bronze throughout. Nozzles can be removed easily from the agitator arm.

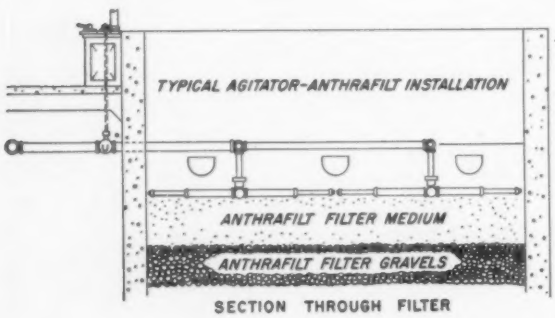
SIZES—Palmer Agitators are adaptable to any size or type of filter. Available in lengths up to 15'.

WATER REQUIRED—The Palmer Agitator operates with low volume at high velocity. Usually, a delivery of ½ g.p.m. per square foot of filter bed is ample.

PRESSURE REQUIRED—40 lbs. and upwards.

R.P.M.—The speed of the Agitator varies from seven to eighteen r.p.m.

SIMPLICITY—Simple to install, easily observed and inspected.



SECTION THROUGH FILTER

The Palmer Agitator consists of a horizontal bronze arm suspended just above the surface of the Anthrafilt or sand. The agitator arm contains jet nozzles through which water is forced at extremely high velocity. The jets are pointed downward to penetrate the filter media before the wash-water is turned on. This penetration breaks up the surface of the filter bed while the agitator revolves slowly, propelled by the velocity of the water through the jets. Thus, the media is in a fluid condition and free from encrusted deposits when the wash water is turned on. When the wash water reaches the level of the agitator arm, the tremendous velocity of the jets causes violent turbulence while the upper strata of the sand or Anthrafilt is expanded. The Palmer Agitator remains in action until shortly before stopping the filter wash.

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Anthrafilt is SELECTED Pennsylvania anthracite, crushed, cleaned, screened and graded to required sizes. It increases the length of filter runs. Requires half the backwash water used for sand; reduces algae troubles to a minimum; is insoluble in acids or alkalies; permits higher filter rates and increases average plant capacity 50%; and there is less coating with inorganic salts. The cost of Anthrafilt is low. We invite technical enquiries.

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At PAK-MOR, research, field testing and engineering have combined to develop the finest refuse collection equipment obtainable at minimum initial investment, maintenance and operational costs.—**PROOF! Because more refuse is handled for less in each PAK-MOR load.**

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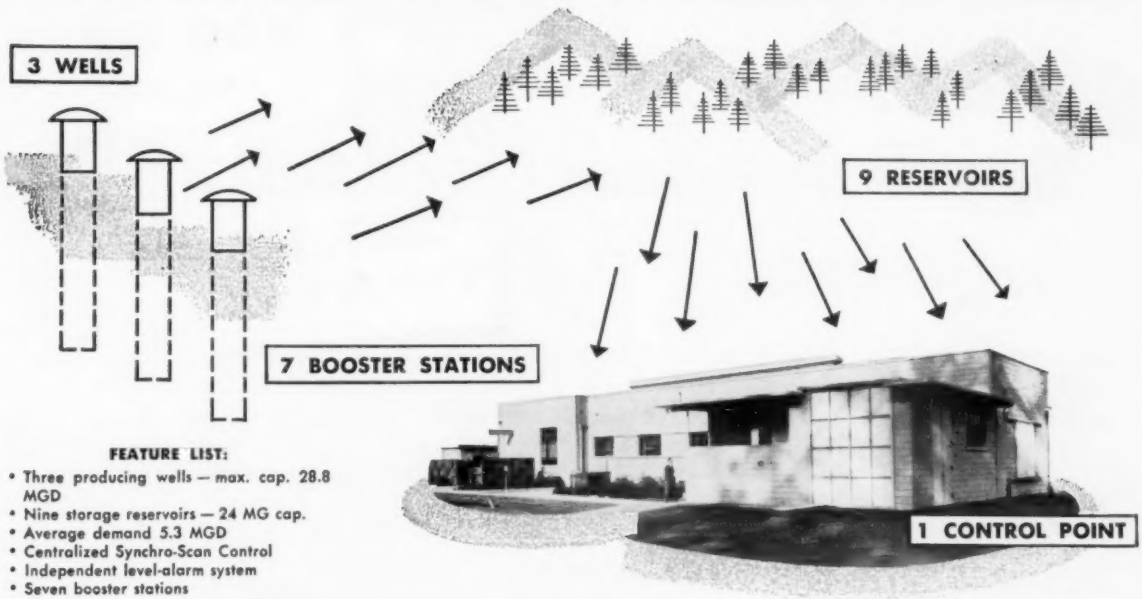
WHITTIER CALLS IT ~~AUTO~~Water MATION



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- Average demand 5.3 MGD
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- Independent level-alarm system
- Seven booster stations

Schematic Sketch — "Water-mation" in Whittier

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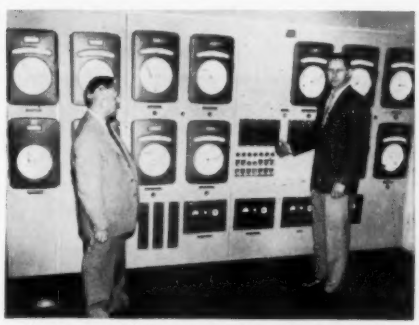
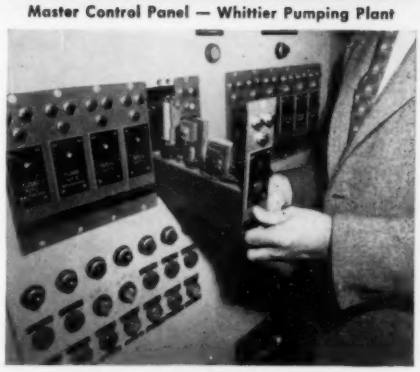
Builders-Providence Synchro-Scan Supervisory Control, by permitting an unlimited number of control or advisory functions to be performed from a centralized control panel, reduces operating costs of widely-spread systems. All supervised units (pumps, valves, etc.) have individual, interchangeable, "plug-in" components on the master panel which, through transmission over leased telephone circuits (or other means of transmission) offer versatile performance and outstanding dependability over long distances. Bulletin 240-M6 gives full details on this economical, multi-function control system. Address requests to **Builders-Providence, Inc.,** 356 **Harris Avenue, Providence, R. I.,** . . . division of



Master Control Panel — Whittier Pumping Plant



Close-up of "Plug-In" Component

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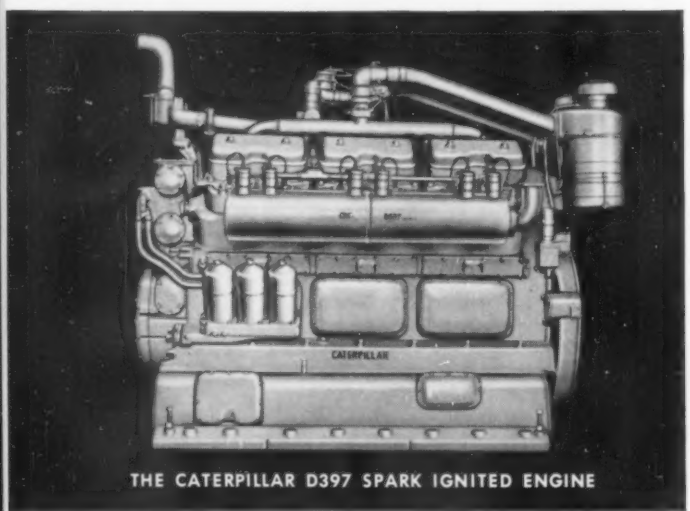

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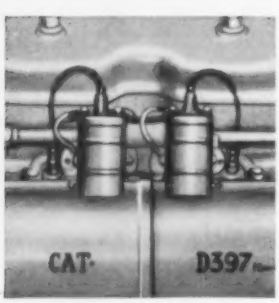

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MODERN HEAVY-DUTY SPARK IGNITED ENGINES

PUBLIC WORKS MAGAZINE
May 1956 • Vol. 87, No. 5

ACTINOMYCETES

MAY CAUSE TASTES AND ODORS IN WATER SUPPLIES

J. K. SILVEY, Director and Professor of Biology, Chairman, Division of Science,

and A. W. ROACH, Associate Professor of Biology, North Texas State College, Denton, Texas

A WIDE VARIETY of biological conditions are associated with sudden outbreaks of tastes and odors in water supplies. Palmer and Tarzwell (1) made an excellent contribution recently, illustrating the relationship of algae to tastes and odors. Reference is made in that paper to the taste and odor contributions by the algae, including specific organisms that may give rise to particular types of tastes and odors. Microscopic animals in water are frequently associated with fishy tastes, and, if they accumulate on filters, the entire area may carry an aroma of dying or disintegrating fish-like materials. The growth of submerged and emergent types of vegetation may give rise to "pickle-like" or "aromatic" tastes and odors in the water surrounding the growing vegetation. It is, therefore, apparent that tastes and odors in water supplies are not caused entirely by one group of organisms but may be contributed by a variety of forms.

During the past seven years we have investigated an interesting group of microscopic organisms known as aquatic Actinomycetes (2) (3) (4) (5). Unfortunately, these aquatic forms have received little attention from the bacteriologists, biologists, or sanitary engineers. They are slow-growing organisms, not easily isolated under routine laboratory conditions, and, as a result, they have not been studied in sufficient detail to be of interest to a large group of investigators.

We are all aware that tastes and odors may occur in streams, particularly rivers, that appear to be devoid of microorganisms. In those instances, opinions were given which indicated that the tastes and odors had originated from disintegrating organic matter. Casual references have been made to the bacteria and/or other microorganisms associated with organic disintegration, although no specific isolations or reports were made. Our research indicates that the aquatic actinomycetes are responsible for a large proportion of the tastes and odors that occur sporadically in the water supplies of many cities that derive their major water source from streams, rivers, natural lakes, overflow reservoirs, or impoundments. From time to time, cities with well-water have noted tastes and odors originating from these organisms that grow fairly well in contaminated distribution systems.

Since the discovery of Streptomycin by Waksman (6), considerable investigation has been expended towards extending the frontiers of knowledge concerning the terrestrial actinomycetes. The reader is familiar with streptomycin, aureomycin, terramycin, and many of the newer antibiotics that are being manufactured by the major pharmaceutical houses. These antibiotics are potent germ-killing drugs that are produced as by-products of the growth of certain of the terrestrial actinomycetes. It is extremely interesting to note that the organisms that contribute a large portion of the tastes and odors to water supplies are related to the life-saving group that produces drugs. The life-history of the aquatic forms appears to be different from that of the terrestrial species, even though a microbiologist would be led astray in looking at only one stage in the life-history of an aquatic form.

This research was sponsored in part by National Institute of Health Grant No. 4179-R.

Life Cycle

The actinomycetes in water supplies usually start from spores, as illustrated in Figure 1. The spores germinate into very small branching filaments which associate themselves with some source of nutrition. That source may be algae, higher plants, or deposits of organic matter in the shallow areas of streams, rivers, lakes, and reservoirs. Since the diameter of the filaments is about 0.5 micron, the actinomycetes would not be observed except under oil immersion, and then, without previous experience with this group of organisms, logical interpretations would not be forthcoming. These primary filaments produce fairly high concentrations of tastes and odors during their early stages of growth. These products generally occur in a regular sequence. The odor-producing species that we have studied. illustrated in Figure 2, first produce a fishy odor. The time or duration of the odor depends upon the temperature and the

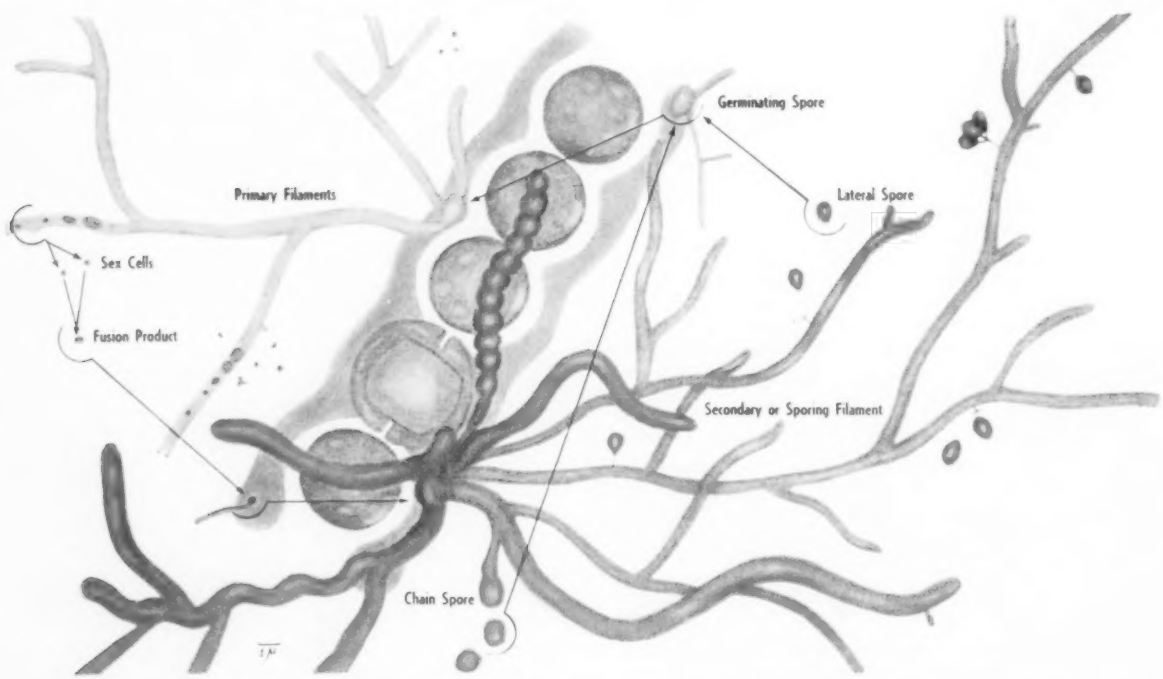
source of nutrition. Generally, we might commit ourselves by saying that the period of fishy odors would run from two to ten days. If the primary stages of the actinomycetes have consumed the available nutrients in that period of time, they will die or give rise to small sex cells that unite to form a zygote, or actinomycete "seed." Consequently, the odor may disappear. If, perchance, the source of nutrition is adequate, the primary filaments begin producing sex cells that unite to form a motile zygote, or actinomycete seed, which soon develops into a large secondary filament (Fig. 1).

The secondary filaments, 0.6-1 micron in diameter, start growing rather rapidly and concurrently give rise to a strong grassy taste and odor in the raw water. This type of odor will last from two to ten days, depending on conditions of nutrition and temperature. If there is adequate food for the actinomycetes, their metabolism appears to alter, and the taste and odor change their characteristics to marshy. The marshy odors are pungent, and, in high concentrations, are very offensive. The duration of the marshy odor and taste in water runs a cycle similar to that of the fishy and grassy odors and tastes. Continued actinomycete growth results in a potato-bin or a slightly musty taste and odor in all the raw water.

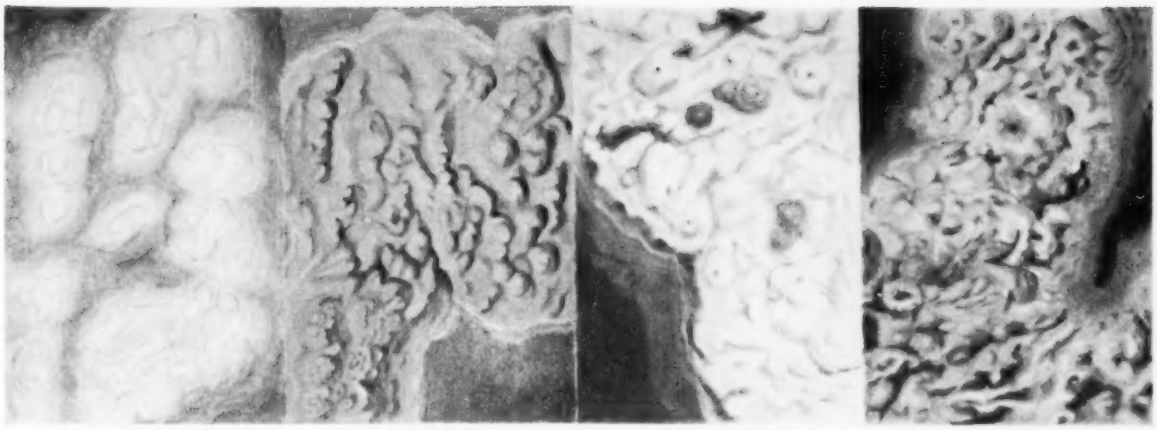
The sequence of odor production described above is rather commonplace. Most readers in close association with water supplies have noted one or more of these tastes and odors in their raw water, and, if bacteriologists or sanitary engineers were available on the staff of the water plant, their microscopic examinations might reveal certain algae in fairly high concentrations. Since the actinomycetes were not observed in the samples, these innocuous organisms would be accused of giving rise to these odors and tastes. If no algae could be found, the conclusions were that certain unknown microorganisms were consuming the organic matter on the watershed or in the shallow areas, which resulted in the tastes and odors in the raw water.

Suppose now we return to the secondary filaments of the actinomycetes that are growing on some type of nutrient in the water. In order to develop this life-history we should propose the presence of some of the blue-green algae, such as *Polycystis*, *Aphanizomenon*, or *Anabaena*. All of these blue-greens are high in available nitrogen and also are subject to forming floating mats, varying in size from a millimeter to several inches. As the nutrition of the blue-green algae becomes relatively poor, the secondary filaments of the aquatic actinomycetes grow profusely on the algal remains. Spore formation now begins to become evident on the filaments of the *actinos*. Some of the filaments produce clusters of large round spores that appear similar to those found in the genus *Micromonospora* of the terrestrial group. Interestingly enough, the same secondary filaments may grow this type of spore and, in addition, may form a long chain-like structure of spores that resembles members of the *Streptomyces* of the terrestrial species (Fig. 1). When these secondary filaments begin producing the various types of spores, a new group of odor and taste compounds are also produced.

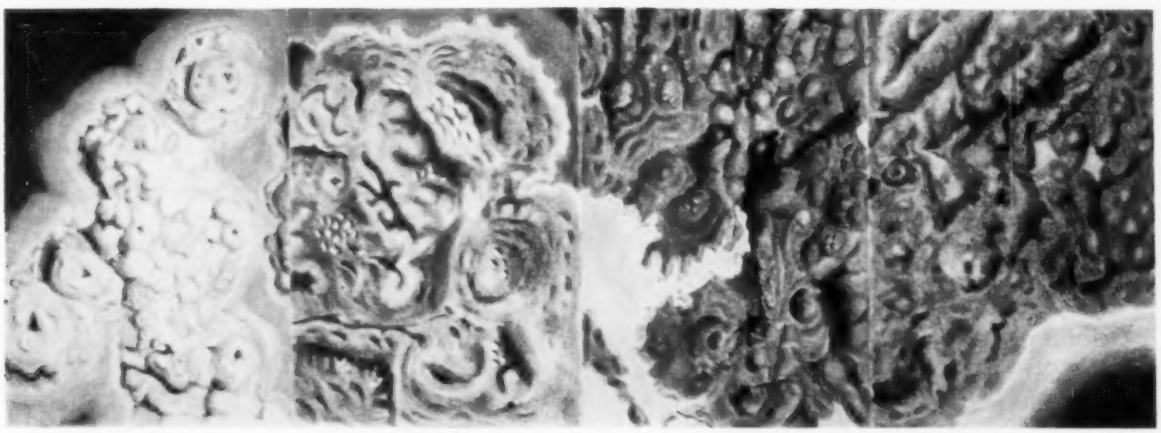
Generally, the first odor to be produced along with the fruiting filaments is a musty odor that is unusually strong, nauseating, and very difficult to remove from raw water. After a period of time this odor will change to a woody, or as we prefer to call it, a rotting wood odor mixed with an earthy odor, both of which are readily detectable. When the secondary filaments have consumed the blue-green algae and all other sources of nutrition, the spores go free in the water, the filaments die, and the odor slowly disappears. If there are available sources of nutrients in the water to support primary hyphae, these spores will



● **FIGURE 1—A TYPICAL LIFE CYCLE. This diagrammatic cycle of a typical bisporulative aquatic actinomycete shows its stages of development. Note that both the primary and secondary stages are associated with a host nutrient source. With favorable growth situations the whole cycle is rapidly completed. Spores remain alive during unfavorable periods.**



Aptissima—Chicago Whites | Calyptroida—Waco Creams | Glaucopprimenda—Palo Pinto Greys | Opprimenda—Pharr Creams



Brevisporulata—Ranger Creams | Pyrospora—Hefner Greys | Pyrospora var. Viridis—Hildago Greens | Apyrospora—Guarico Fuscous-Greys

● **FIGURE 2—ODOR-PRODUCING species of actinomycetes. Detailed characteristics of these species are noted below.**

Chicago Whites—characterized by its transitory primary phase, small, prolific lateral spores (0.2-0.4 μ diam.), secondary filaments (0.5 μ diam.) and sparse, late, very large chain spores (1.2-1.4 μ diam.). Grows poorly on all media except Emerson's agar. Odor a light potato bin during lateral sporulation, the old slants becoming strongly acrid-musty. Isolated from Worth Ranch, Texas, Oklahoma City and Chicago waters.

Waco Creams—distinguished by its basally restricted branch buds, the lateral sporing filaments being smaller than the concurrent chain sporing filaments. Both spores are of the same size (1 μ in diam.). Grows well on all media. Mature colonies have a strong musty odor. Isolated from vegetation at Waco and water at Oklahoma City.

Palo Pinto Greys—a group having concurrent sporulation from the same filaments which become unstable at maturity. Lateral spores 0.3 μ, chain spores irregular and 1 μ in diam. Massive growth on all media. Odor from active sporulating colonies, heavy and pungent grain dust like. Found in Palo Pinto, Texas, and Los Angeles water.

Pharr Creams—very similar to the Palo Pinto Greys except the lateral spores are larger and more sparsely clustered and the chain spores smaller. Growth massive on Emerson's and Sabouraud's agars, and potato plug, depauperate on others. Odor pronounced musty in mature cultures. Isolated from Oklahoma City vegetation and water, also from Philadelphia, Parr, Texas, and Venezuela waters.

Ranger Creams—primary filaments persistent in life cycle. Stable secondary filaments producing a few lateral spores in clusters of 1-3 early in life cycle, becoming barren and eventually producing symmetric chain spores (1 μ in diam.) at the end of the life cycle. Grows best on nutrient and Emerson's agars. Odor heavy dry-earthy on all media. From waters of Ranger and Tyler, Texas.

Hefner Greys—typified by massive sporulation of lateral spores 1-1.2 μ in diam, which stain poorly in center. Depauperate chain spore filaments appear sparsely after shattering of lateral spores. Massive growth only on Emerson's agar and potato plug. Odor lasting for months in old cultures, earthy becoming musty. Isolated from waters and vegetation of Oklahoma City, Tyler, Texas, Chicago and Los Angeles.

Hildalgo Greens—similar in all respects to the Hefner Greys except becoming a verdant green at maturity on all media and losing odor. From water at Hildalgo, Texas.

Guarico Fuscous-Greys—secondary filaments never producing lateral spores. Grows well on all media. Odor transitory, light, and of an earthy odor. Isolated from Venezuela and Oklahoma City waters.

germinate, and fishy odors will return. This is indeed an interesting cycle of events that commonly occurs in all surface waters throughout North America. It is easy to understand why the literature on tastes and odors in water supplies carries hundreds of misstatements concerning specific organisms that produce tastes and odors, while the true causative organisms had neither been isolated nor studied.

Investigations on culturing the aquatic actinomycetes have been conducted in our laboratories for several years. Recently, we have been able to develop a system for rearing these organisms that fairly

well duplicates the natural conditions under which the taste and odor producers grow (Fig. 3). The equipment concerned is composed of vertical glass columns approximately four inches in diameter and five feet in height. These columns are equipped with resistance wire units so that they may be properly sterilized and the inlets and outlets are connected to the sealed columns which permit the introduction of artificial medium and the continuous flow of sterile air. In employing artificial medium under sterile conditions and by rearing the various types of actinomycetes (Fig. 2), the entire life-history of these forms may be studied in the columns. The sterile air that passes through the columns picks up the volatile taste and odor compounds and carries them by means of connecting tubing into scrub bottles that are filled with carbon. In this manner the taste and odor compounds can be accumulated onto granular carbon and later eluded for chemical studies. Temperature, nutrition, and many other factors that are important in any study of the environmental factors, which contribute to the growth of these obnoxious organisms, may be controlled in the laboratory. This equipment in all probability will prove to have practical value in the future since it is possible to get samples from a surface water supply at a time when no odors or tastes are present. Since the actinomycete spores are continuously available in the water, the organisms may be cultured from the water samples grown in the columns and the taste and odor compounds collected. These compounds can be added to large volumes of water, and complete pilot plant tests can be run to determine the most efficient methods that a regular water plant can employ for reducing or removing the taste and odor compounds from the raw water in order to furnish a palatable item to the water consumer.

Control Methods

The reader would probably be interested in some means of control of the actinomycetes, since they appear to be major contributors to the production of tastes and odors in surface waters. For a great many years copper sulphate has been employed to control algae in water supplies. It has been noted that a reduction in algal population does not immediately result in a reduction in tastes and odors. This is due to the fact that the actinomycetes continue to feed on the algal remains until entirely consumed.

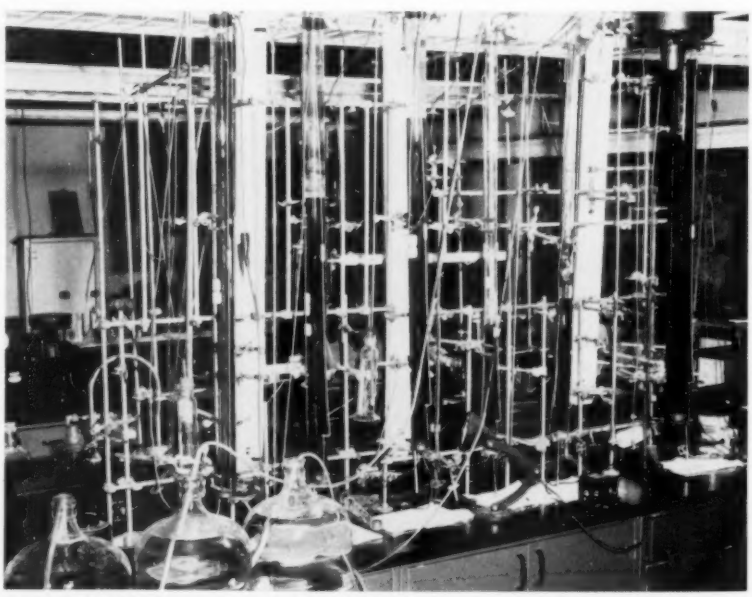
Frequently one may reduce an algal population in surface water and have a continuance of obnoxious tastes and odors. This is probably due to the fact that algae themselves were not supporting the actinomycetes to begin with, but rather that the latter were growing on some other source of food. In general control, we do not suggest the eradication of algae unless they occur in unusually high concentration and are present as attached or sessile types, as well as in planktonic forms. It seems more appropriate to spend the money in the water plant since that is going to be necessary regardless of the control practiced. An exception might be noted if higher plants are the source of nutrition, since a continuous flow of copper may act as a suppressive agent against higher plants, and the actinomycetes cannot grow because of lack of nutrition.

Unfortunately, the aquatic actinomycetes are not vulnerable to concentrations of copper as high as 50 ppm nor chlorine as high as 25 ppm. That statement indicates that we know of no control that may be used in fertile surface water supplies to reduce these organisms. As long as the nutrients are available and the temperature is optimum, that is, 60° to 90°F., it is likely that these forms will grow. Consequently, some of our investigations concerning by-products of the actinomycetes have centered around means or methods by which these taste and odor compounds may be removed from the raw water. It would be proper to consider the different odors and the best treatment so far as we are aware.

Since fishy odors appear first in the life-history stages of the aquatic actinomycetes, we might consider methods of controlling this type of taste and odor in surface water. Several compounds are available that are quite useful. Pre-chlorination in variable concentrations will reduce or destroy the fishy odor. If the water plant cannot use prechlorination, then small quantities of powdered activated carbon or granular activated carbon remove the compounds rather effectively.

Grassy and marshy odors are not quite as readily removed. Prechlorination will reduce a grassy odor but will not remove it. Breakpoint chlorination will occasionally reduce the grassy odor to such a concentration that it is not readily detectable. If prechlorination is not practiced, powdered activated carbon or granular carbon can be employed in the purification plant to adsorb the odor. Marshy odors are infrequently controlled by breakpoint chlorination. Normally, they are enhanced by this practice, and even though 500 ppm is applied to water, the organic chloramines formed are not oxidized. Consequently additional purification practices are indicated. In this case chlorine dioxide may be substituted for chlorine, and, if it can be generated chlorine free, small concentrations will oxidize the odor and taste compounds. If the water plant

(*Continued on page* 210)



● **LABORATORY** apparatus used to rear cultures of actinomycetes and to determine the effect of these organisms as a cause of tastes and odors in water. Fig. 3.

● GOOD example of number on mail box in rural area.

● BOTH old and new numbers are displayed for 90 days.

County Road Naming and House Numbering

N. L. WOODS,
Asst. Supt. of Highways,
Peoria County,
Illinois

PRIOR TO 1951 no governmental body in Peoria County, Ill., had specific authority to name or change names of streets or to regulate the numbering of houses in the unincorporated areas of the County. As a result, in the metropolitan area outside the City of Peoria, the haphazard method of selecting names and numbering houses without any centralized authority to pass on these selections resulted in a duplication of street names and a highly uncoordinated and unrelated system of house numbers.

As the various subdivisions and developments adjacent to the City were laid out street names were assigned by the subdivider without thought to possible conflict with other streets in the metropolitan area. Since there was no centralized authority or any general plan the houses were numbered by the subdivider, by the contractor or by the house owner himself.

Increasing difficulties in locating houses in the unincorporated areas of the County adjacent to the City of Peoria by the postal, fire and police departments; by public utilities, and merchants; and by the people themselves emphasized the need for some uniform system of house numbering.

On May 4, 1951 the Illinois State Legislature passed a law authorizing County Boards to name or to change the name of any street, lane, road or highway and to regulate the numbering of buildings and lots adjacent to any street, lane, road or highway in the unincorporated area of any County.

Thus at last, the State Legislature had provided the necessary centralized authority to set up a uniform system of house numbering. This law, of course, is discretionary and not mandatory. It was therefore up to each County to decide if such a system was necessary and to set up plans, rules and regulations.

In anticipation of the action of the State Legislature the Peoria County Board of Supervisors created a new Committee to prepare and administer such a plan. This Committee was and is known as the Street Names and Numbering Committee of the Board of Supervisors.

Factors in Numbering

In preparing a uniform system of house numbering in any area there are, of course, numerous factors to consider. There are many good plans for a uniform system of house numbering and street naming but most of them are based on discarding the existing system, either in whole or in part. Also, as a result of a study of the various systems in effect in other localities, it is obvious that there is no simple uniform standard plan. Each locality has its own problems controlled greatly by topography and the existing layout of streets.

It must be remembered that, in considering a plan for a uniform system of house numbering in unincorporated areas, the County had no jurisdiction within the City Limits of Peoria. It must also be remembered that approximately two-thirds of the population of the County of Peoria is within the Peoria corporate limits.

The problem then became one of adopting a uniform system in the County that would fit in with any future system that might be adopted by the City. At that time there was no assurance that the City of Peoria would ever renumber houses in the City.

All the confusion and hodgepodge of numbering that had been generated in the City was naturally magnified many times at the corporate limits. Therefore, to avoid further confusion by laying out an entirely

new plan, it was logical to consider the system then in use in the City.

A survey of the numbering system in the City and the area adjacent disclosed that generally the so-called block system was used. In this one hundred numbers were available for each block, the odd numbers on one side and the even on the other. Numbers were generally assigned by lots rather than by any particular unit of frontage.

New blocks began at each intersecting street. This, in many cases, caused confusion because there was no standard number of streets per unit. Although by no means uniform the general pattern indicated twelve blocks per mile.

It seemed logical that the numbering should be based on some definite base lines instead of the existing unrelated method with the resultant confusion in numbering. Base lines or reference lines dividing the area into sections may be useful in simplifying the system as a whole and in making it easy to find numbers. In the selection of these base lines a system had to be used that would fit in with the general system then in use and also to fit in with any system the City of Peoria might adopt in the future.

Base lines can be either definite streets or imaginary lines. From the standpoint of the person looking for a number the base line has little significance for he finds his objective without actually starting at the base.

Considering all these factors a suggested plan for Peoria County was prepared by the writer and submitted on June 25, 1951, to the Committee on Street Names and Numbering for consideration, with the recommendation that the plan be submitted to other organizations for criticism and suggestions.

For almost one year this plan was studied by various units, including the Committee of the Board of Supervisors, the Peoria Engineering Council, Peoria County Planning Commission and others. As a result of this study an ordinance was drawn up and submitted to the Board of Supervisors. This ordinance, which was approved by the Board of Supervisors in March, 1952, is so simple, brief and uncomplicated that it is included in this article. The ordinance which is entitled "An ordinance relating to the naming and numbering of streets in the unincorporated area of Peoria County" is as follows:

1. Base Lines.—There is hereby established a uniform system of numbering all houses and buildings, now constructed or hereafter constructed, fronting on all streets, avenues, alleys and highways in the unincorporated area of Peoria County. In this system the base line for numbering east and west streets shall be Franklin Street from the Illinois River to Knoxville Avenue, Knoxville Avenue and the line of Knoxville Avenue extended north through the center of Sections 16, 9 and 4 of Richwoods Township, center of Sections 33, 28, 21, 16, 9 and 4 of Medina and Hallock Townships to the north county line. The base line for streets running north and south shall be a line extended one and one half miles south of, and parallel to, the north line of Peoria, Limestone, Logan and Trivoli Townships. This latter base line within the Corporate limits of the City of Peoria follows Aiken Avenue, Eckley Avenue, Prairie Avenue to Franklin Street and the line of Prairie Avenue extended east to the Illinois River.

2. Numbering System.—Areas to be numbered shall be blocked out by a uniform grid so as to consist of 12 blocks per mile. One number shall be assigned to each 30 feet of frontage whether improved or unimproved and where more than one number is necessary within a space of 30 feet suffixes "A", "B", "C", etc., shall be added to the proper number. Each block shall begin with the number 100 or multiples thereof with odd numbers on the north and west side of a street and even numbers on the south and east side of a street. Diagonal streets shall be designated north-south and east-west according to their predominant line of direction and if exactly 45 degrees shall have a north-south prefix. Diagonal streets shall be numbered to coincide with block numbers established for the adjoining east-west, north-south blocks.

3. New Housing Areas and Subdivisions.—It shall be the duty of anyone laying out a new housing area or subdivision to prepare and submit a house numbering grid which satisfies the requirements outlined herein with regard to both street names and numbers to such committee, or county officer as shall be designated by the Board of Supervisors.

4. House Numbers.—When properly notified in writing, it shall be the duty of the owners and occupants of any house or building in the previously specified area to have placed thereon in a location readily visible from the street (or road) and in numbers at least two and one-half inches high the assigned number for that house, or building. Buildings which already carry numbers shall retain both old and new numbers for 90 days after notification, thereafter the old number shall be removed.

5. Naming and Renaming Streets and Roads.—Streets and roads shall generally retain their historical and familiar designations. Where necessary, new streets and roads will be assigned names by the Committee designated by the Board of Supervisors; in those instances where duplicate names have been assigned to a street or road, or identical or

● **ROAD SIGN installed by the County at the intersection of county highways.**

nearly identical names have been given to different streets or roads, such Committee, shall have the right to change the name. Changes may also be made by petition of the majority of residents living on a given street or road addressed to the Board of Supervisors, and the Board of Supervisors shall allow or deny the petition; provided, however, any objecting property owner on such street to be named, or renamed, may request a public hearing thereon. In such case the hearing shall be held, after 15 days notice of time and place of said hearing before such Committee designated by the Board of Supervisors, and such Committee after hearing, shall report its recommendation to the Board of Supervisors for final action.

6. Administration and Penalty for Violations. — Street naming and numbering shall be under the jurisdiction of such committee or County

Officer as shall be designated by the Board of Supervisors. The Board of Supervisors shall have prepared and shall maintain a detailed map of the County streets and roads with their proper names and numbers and changes thereto, which map shall be open to inspection by the public.

Any person, firm or corporation violating or failing to comply with any of the provisions of this ordinance shall be punishable by a fine of not exceeding Fifty Dollars ($50.00) for each day such violation continues.

7. This ordinance shall become effective upon its passage and may be amended at any regular session of the Board of Supervisors.

● **IDENTIFICATION** sign at a road intersection with directional arrow.

City-County Cooperation

Before this ordinance was adopted by the Peoria County Board of Supervisors the Committee on Street Names and Numbering met with the Peoria City Council and the Council agreed to use the same uniform numbering system in the City when and if the City should adopt such a plan.

In 1952 the Committee numbered houses on two main streets extending into the County from the corporate limits of the City. One of these was Knoxville Avenue, the north and south base line, the other street was Lincoln Avenue, a street running west from the city on which the existing numbering system was badly confused.

At that time only these two streets were numbered, mainly for the purpose of a trial run in testing the uniform house numbering system and also to arrive at some basis of cost of doing the work. As a result of this test minor technical difficulties were solved before any large scale numbering was done by the County.

In any plan such as this there will always be special cases that will have to be solved individually. Rather than to attempt to solve all these special cases by ordinance the solution was left up to the Committee.

In this article the writer has purposely left out the actual detailed maps and engineering work involved in the computation and assignment of numbers. In general the Committee uses the same treatment of these special cases as outlined in the ordinance adopted by the City of Peoria. This ordinance was well explained in another article previously printed in this magazine.

In Peoria County the volume of numbering is governed by the amount of funds appropriated each year by the Board of Supervisors. Since there is no County Office responsible for the numbering, the actual engineering work is done by private engineering companies on a contractual basis subject, of course, to the approval of the Street Names and Numbering Committee. For the past five years the writer has worked with and advised the Committee, not as a representative of the County Highway Department, but as an individual interested in the system.

In 1953, 1954 and 1955 the County numbered the fringe areas north and west of the City and extending three to five miles outside the City Limits. In 1955 the City of Peoria using the same system numbered the north one-third of the City and this year the City expects to complete the entire incorporated area.

The County now is in process of completing the area around and contiguous to the City. Therefore by the end of this year the City of Peoria and the fringe area will all be numbered in accordance with the uniform house numbering plan.

Each year, depending on funds available, the County expects to extend the numbering system farther out into the County. The system is a County-wide one but it is not expected that the need will ever arise for complete County coverage. It is anticipated at this time that only an area from ten to twelve miles from the City limits will be renumbered.

Up to date the cost of numbering has ranged from $1 per house to $3 per house depending on the concentration of houses. Naturally as the system expands into the County with less concentration of houses the unit cost per house will increase. This cost compares favorably with the cost shown in the City which is from 50 cents to $1 per house. It is obvious that there will be a denser concentration of houses in the City with resultant lower unit cost of the engineering work involved.

As for naming and renaming of roads and streets the Committee feels that any action should be initiated by the residents on those streets. The past year there have been many petitions submitted to the Board of Supervisors by the residents requesting that name changes be made to eliminate duplication.

Furthermore the Peoria County Zoning Ordinance was amended to require all new subdivisions to be submitted to the Street Names and Numbering Committee for preliminary approval for the prime purpose of eliminating duplication of street names.

In conclusion the writer can only give this advice to any one contemplating the adoption of such a system for any community—no matter what plan is adopted a great deal of concern and objection must be expected. No matter what changes are contemplated there will always be personal and selfish prejudices to be overcome. But the experience obtained in this County was that, after the work had been completed, it was generally admitted by those most concerned with the changes that there had been little confusion.

As a result of the uniform house numbering system in both the County of Peoria and the City of Peoria it was found that approximately 95 percent of the residents accepted the system without expressed protest. The storm of protest that arose from each period of numbering therefore represented only 5 percent of the residents affected.

It is the opinion of the writer that no community can afford not to have such a uniform house numbering system or street naming plan. The results of such work will return to the community many times the cost and slight inconvenience involved in putting the plan into operation.

STAGE CONSTRUCTION MATCHES

THE RAPID GROWTH of Florida has created many problems in waste disposal. In a recent paper before the National Association of Homebuilders, John W. Wakefield of the Florida State Board of Health gave several examples of the methods used by consulting engineers to solve the problem of handling sewage in large developments and during the period of their growth. The following, taken from the files of the Sanitary Engineering Bureau, illustrates some of the means employed. Costs are estimates only and rarely include cost of land or other incidentals.

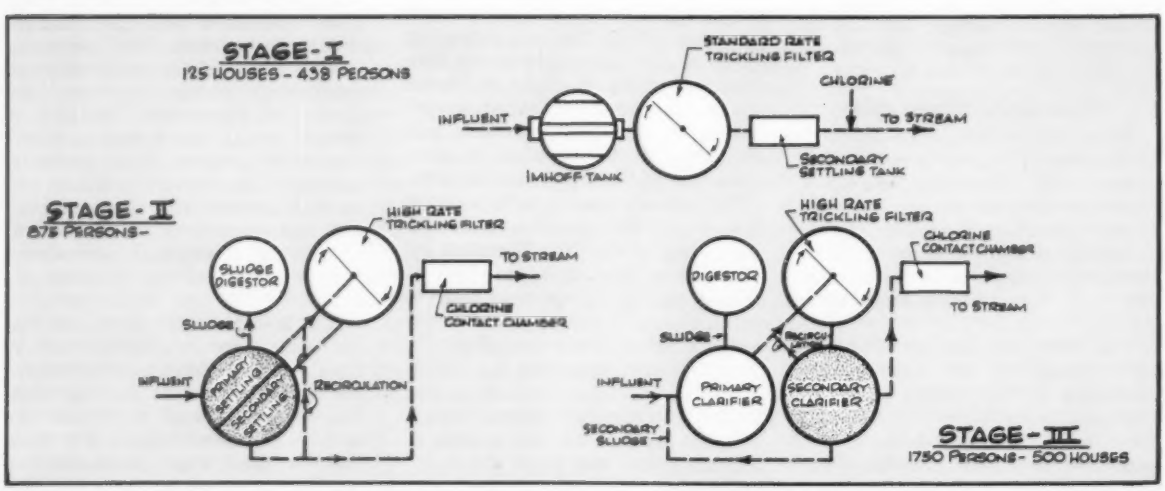
Leisure City, Dade County, Designing Engineers, Rader Engineering Company, Miami.—The housing in this subdivision in lower Dade County was planned for development in 10 stages and the sewerage system including the treatment plant was planned for similar expansion. Each increment of houses was to be served by an independent sewage collection system which included a lift station. All lift stations discharge to a common force main which transports the sewage into the first treatment unit. There is no stream available into which the effluent may be discharged but the porous lime rock lies near the surface of the ground. It was planned, therefore, that the final method of disposal in all cases would be through an intermittent sand filter and thence directly into the ground waters. (The water supply was not involved at this stratum). The initial treatment plant consisted of a round Imhoff tank, a dosing tank and two sand filters. As the housing for each stage is added so also are additional treatment devices. Stage B merely adds another Imhoff tank and more filters. At Stage C the Imhoff tanks are to be converted to sludge digesters for which the piping has already been provided and two primary settling tanks are to be constructed. At Stage E a trickling filter and secondary settling tank is added which reduces the organic loading reaching the sand filters. Additional sand filters and sludge drying beds are added as required.

The plan provides for serving 1407 people with the first of eight stages of plant expansion, with the final stage serving 13,227 people and treating a flow of 1.19 mgd. Cost per lot for the first unit is estimated at $66; and for succeeding stages the cost will be reduced slightly, with a final total cost of $223,706 or $50.50 per lot.

The treatment unit cost is prorated so that no section of housing is unduly taxed and by adding treatment units in front of the sand filters, as well as by increasing the number of filters, the organic loading on the filters actually is less at the end of the proposed development than at the beginning.

Lyons Park, Broward County, Designing Engineers, Philpott, Ross and Saarinen. Fort Lauderdale, Florida. This plant is designed for an initial load of 438 people (125 living units) with an ultimate load of 1750 people or 500 living units. The first unit consisted of an Imhoff tank but the trickling filter for the ultimate development is included at the start. Due to the small initial load the tank ultimately used as a chlorine contact chamber was initially used as a secondary settling tank. In Stage II, the Imhoff Tank is to be converted to a digester and a patented combination primary and secondary settling tank is to be used. The initial secondary settling tank is then converted to a chlorine contact tank and the somewhat lesser efficiency to be expected from the dual clarifier, as compared to separate primary and secondary clarifiers, is compensated for by relatively low loading on the filter and by a high rate of recirculation of effluent back to the filter. In the final stage the combination clarifier is converted to a primary clarifier and a separate secondary clarifier is constructed. The Engineers estimated Stage I to cost $75,000, including a pumping station, or $600 per house; Stage II to cost $40,000 more than the first or $460 per house; and the ultimate plant to have a total cost of $140,000 or only $270 per house.

South Miami Heights, Dade County, Designing Engineers, J. F. Cooper and Associates, Miami. This subdivision is planned for an initial stage of 300 houses with three subsequent stages to 17,500 people or 5,000 houses. The initial stage for the sewage treatment plant is a septic tank and sand filters. The septic



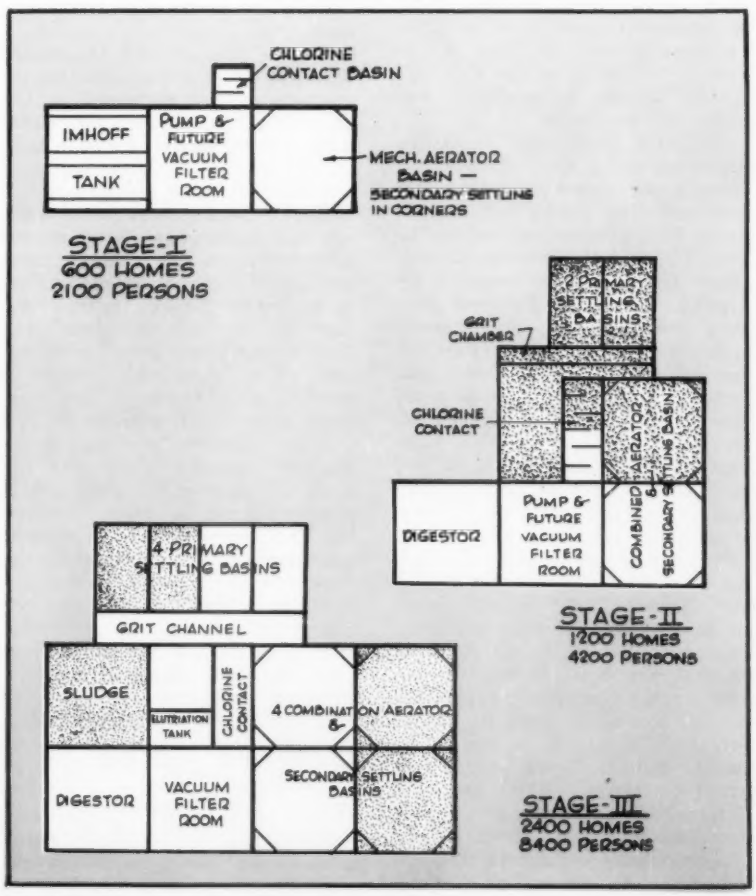
● **THREE stages of construction for Lyons Park are shown here. Final cost for complete treatment amounts to $270 per house.**

SEWAGE TREATMENT TO SUBDIVISION GROWTH

is subsequently converted to a primary clarifier preceding diffused-air activated sludge tanks. The Engineers estimate that the sewage treatment plant for Stage I will cost $59,500 or $198 per house; and the total cost for the ultimate plant will be $470,000 or $94 per house for 5,000 houses.

Lake Shore Terrace, Duval County, Reynolds, Smith and Hills, Designing Engineers, Jacksonville. This subdivision was designed for an initial stage of 560 people or 160 houses. The receiving stream is a comparatively large tidal stream used quite extensively for fishing and recreation. Due to upstream sources of waste the dissolved oxygen in the stream was already partially depleted. The Engineers estimated and the State Board of Health agreed that the stream could carry the initial load, with only primary treatment followed by chlorination. The State Board of Health required, however, that for the ultimate development for 1287 people, secondary treatment be added to reduce the oxygen depleting potential of the sewage prior to discharge to the stream. The Imhoff tank used for primary treatment was designed for the ultimate load and in the initial stage primary effluent was chlorinated. After the number of houses had reached 160, a trickling filter and secondary settling tank was added allowing the completion of the development.

Myrtle Grove, Dade County, Rader Engineering Company, Designing Engineers. This subdivision located northwest of Miami has an ultimate size of 10,000 houses or 35,000 people. No receiving stream is available but since the developers required a considerable amount of fill it was proposed to construct a large artificial pond, the level of which would be controlled by the ground water level. Surface drainage from the entire area is also to the pond so an overflow is provided through a drainage ditch to a surface stream. The engineers proposed in their preliminary report to construct an activated sludge type sewage treatment plant utilizing multiple mechanical aerators for stage development. The sewage treatment plant is located on the shores of the artificial pond adjacent to the water treatment plant and due to its position near the center of the housing area it was decided to enclose the entire plant. The first increment consisted of a rectangular Imhoff tank, one mechanical aerator that combines secondary settling, and a chlorine contact chamber. It was estimated that the initial stage would serve 600 houses at a cost of $93,350 or $156 per house. In the second stage the Imhoff tank is converted to a square digestor with a floating cover; one primary settling tank and a combination aeration-secondary tank are added to raise the design load to 1200 houses. It was estimated that this stage would cost $100,000 or a total for both stages of $161 per house. The third stage contains 2 digesters, 4 primary settling tanks, 4 aeration-secondary tanks, a chlorine contact chamber and a vacuum filter for digested sludge drying to serve 2400 living units. The ultimate plant will serve 10,000 living units and has 5 primary tanks, 14 mechanical aerators, 5 secondary settling tanks, 2 elutriation tanks, and a chlorination tank. It was estimated to cost an additional $750,000 over the second stage, making a total plant expenditure of $943,000 or $94.30 per house. The entire structure is built with common walls between tanks and housed in a building that would do credit to any country club.



● **DESIGN of stage construction for Myrtle Grove. Treatment will be by activated sludge. First stage costs are $156 per house; final stage costs will be $94.30.**

PROTECTING HIGHWAYS *with* ROADSIDE VEGETATION

FRANKLIN T. ROSE

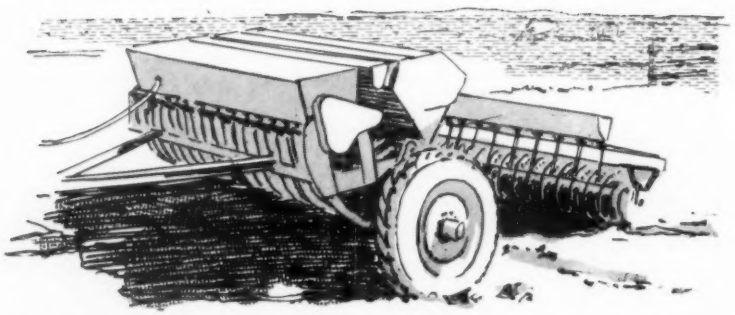
Landscape Architect

State Highway Commission of Kansas

FEDERAL and State highways, totaling approximately 9,400 miles in length, pass thru a wide variation of growing conditions in the State of Kansas. To reduce soil erosion on shoulders and highway slope areas the roadsides are seeded to grasses and legumes soon after the grading contractors complete grading operations. The importance of roadside vegetation in reducing maintenance cost and also in improving the safety of the highways is well known to engineers and many highway users.

Obtaining satisfactory vegetative protection along the highways is a difficult task in some areas. On virgin grassland soils and on fertile cultivated soils, good vegetation can be grown. Man-made problems develop when the topsoil is removed by grading operations. The raw subsoils, sterile shales, clays, sandy soils and other kinds of soils are left exposed to the action of wind and "splash" erosion. Fill slopes composed of sandy soils, cut and fill slopes in the very erodible loess soils and disturbed portions of "old sand dunes" are among the areas that need special treatment in order to obtain a stabilizing grass cover.

Weather, a much talked about but uncontrollable factor affecting plant growth, pretty largely determines what kinds of crops will make satisfactory growth in the different parts of the state. In the wooded, hilly sections of eastern Kansas, rainfall averages about 36 inches per year. The greater portion of the annual rainfall comes during the growing season (March through October) at the time it is most beneficial to crops. Many species of grass, trees, and shrubs that are ndigenous to Pennsylvania, Ohi. and Kentucky are adapted to eastern Kansas as this portion of the state is also in the cool humid plant zone.



● **ADEQUATE preparation of the soil and modern seeding equipment are essentials in the planting of seeds. Here a farm drill, cultipacker and seeder are being used.**

On the prairies and the rolling wheat lands of western Kansas the average rainfall decreases to less than 20 inches per year. Drier atmospheres, higher summer temperatures, and strong unobstructed winds are some of the factors that influence plant growth in the western half of the state. Wind erosion often punishes the newly graded sections of highway by shelling off, in sandpaper fashion, layers of soil from the shoulders and slope areas. The moving grains of soil often will clip off a fairly high percent of seedling grass plants as they push their tender heads through the soil.

If one holds his bare hand on the highway shoulder about five feet from the edge of the pavement as a speeding car or truck "swishes" by, he is surprised at the stinging sand and soil particles that hit his hand. Wind suction, caused by speeding vehicles, whips up the blistering soil partic'es, which in turn clip off the heads of many sprouting grass plants. Not only is the grass stand thinned out, but continued "swishing" and "whipping" causes some loss of soil along the edge of the pavement.

Grass Varieties

Hardy, drouth-resistant native grasses are the principal species used in soil erosion control work in western Kansas. Western Wheatgrass, a medium tall-growing grass that spreads by underground rhizomes as well as by seed is the principal variety planted. Buffalo Grass, a very dwarf "shortgrass" variety spreads by surface runners as well as by seed. This grass, along with Bluegrama Grass, prefers the "hard-land" soils and is planted in limited quantities on highway shoulders. Other natives that are planted on shoulders and on slope areas include Little Bluestem, Sideoats Grama, Switchgrass and Sand Dropseed. Characteristic of the native species is their slow, deliberate method of germinating and their slowness in producing a vegetative cover. To obtain a quick protective cover, several adapted "cultivated" grasses are used in the seeding mixture along with the "natives".

Alfalfa is the chief legume used throughout the state. Yellow Sweet Clover seed is planted in borrow pit areas and on many of the rocky and the shaly cut slopes. Domestic Ryegrass is used in all seeding mixtures since this variety germinates and grows quickly, thus giving protection to the slower-growing varieties. Intermediate Wheatgrass and Smooth Bromegrass have both proved valuable on the "hardlands" of northwest Kansas.

In eastern Kansas the principal vegetative roadside cover consists of Bromegrass, Alfalfa and Kentucky Bluegrass. Lesser quantities of Little Bluestem, K-31 Fescue, Red Top and Ladino Clover are used in combination with Brome

and Airalra on many projects in this portion of the state.

It is not practical to set up standard mixtures of seeds for the several parts of the state. Each highway project is studied separately. A mixture of native and adapted varieties is determined according to local growing conditions. The total quantity of seed in the mixture usually runs about 40 to 45 pounds per acre. Between 200 and 300 pounds of commercial fertilizer, containing 15 percent nitrogen and 15 percent phosphorous per acre, has proven sufficient to get the cover crops established. Kansas soils, with the exception of the southeast area, are well supplied with potassium, so this element is applied on only a very few projects.

Fertilizer and Mulch

Agricultural limestone, where needed, is added to acid soils in order to bring the pH value of the soil to near neutral. Commercial fertilizers are applied to give the legumes and grass plants a quick start and to supply the soil with life-sustaining plant nutrients. Straw mulch is placed on the sterile cut slopes and on the more erodible soils in order to help the seedling plants become established. Such areas receive a little higher rate of fertilizer and seed; then a thin layer of straw mulch is placed over the seeded slopes. The straw mulch (1) provides immediate protection against "splash" erosion; (2) prevents hard rains from sealing clay type soils; (3) keeps the surface soil moist and prevents crusting of the surface, thus aiding the emerging seedling plants; (4) protects the seedling plants from torrential rains or blistering hot winds; and (5) adds a small amount of organic matter to cut and fill slopes that are very low in organic matter.

Contractors use straw-blowers to place the straw mulch. On the average about two tons of straw per acre is applied. Wheat straw and prairie hay are the principal mulching materials. Oat straw, when available, mouldy alfalfa, soybean stalks and sorghum butts are sometimes used in limited quantities. Soon after the straw is placed on the slopes, a soil erosion mulching tiller firms the straw mulch, pushing a portion of the straw into the soil. The mulching tiller is a disc-like piece of equipment having 8 to 10 scalloped disc cutting-blades mounted on a heavy axle. The discs are spaced about 9 inches apart. Weight boxes on each side of the axle will carry about 1,000 pounds of sand, rock or concrete blocks. This extra weight is required only where soils are hard.

● **THE "SOIL Erosion Mulching Tiller" has scalloped discs which pushes part of the straw into the soil. The tiller is being pulled by an Oliver-Cletrac HG tractor.**

Planting Procedures

Bermuda Grass, a tight sod-forming species is adapted to southern Kansas. In this state, Bermuda grass is started by planting divided roots (rhizomes) in furrows 3 inches deep and 24 inches apart. Roots are obtained from old established plots by plowing the plots and shaking the soil off of the long rhizomes. The rhizomes (3 inches to 18 inches long) are laid end to end in the furrow, covered, and watered. Sandy fill soils and steep slopes adjacent to overpasses and underpasses are planted to this grass. Mechanical planters cannot operate on these steep slopes, therefore, hand planting is necessary. Hand labor methods make planting costs rather high as compared to the cost of seeding other roadside areas. Consequently, only a few selected areas are planted to Bermuda grass sod each year.

Maintenance forces in each of the six State Highway divisions seed about 100 miles of roadsides annually. This work is done primarily on reshaped sections of shoulders and on sections of ditches and slope areas that are regraded by state forces.

Contractors do practically all of the seeding and mulching on newly constructed projects. Seeding contracts are let separately from the grading, surfacing and paving contracts. During the 1955 Spring season (February 15 to April 20) and the 1955 Fall seeding period (August 15 to October 1), fifteen seeding contractors completed ninety contracts covering 326.3 miles of highway. A little over 5,100 acres of roadsides were seeded and 526 acres of steep slope areas were mulched.

● **LOESS soils in Northwestern Kansas are successfully stabilized with Western Wheatgrass and Achenbach Bromegrass.**

● **ACHENBACH Bromegrass forms a thick, tough sod that resists water erosion on sloping areas and in highway ditches.**

Seeding and fertilizing averaged $37.83 per acre, or less than four-fifths of one cent per square yard of area. Straw mulch, where used to stabilize slope areas, cost an additional $145 per acre, or three cents per square yard. Thus, seeding, fertilizing and mulching cost about four cents per square yard of area.

Kansas farmers living near the State and Federal highways appreciate the soil erosion control work that is carried on by the State Highway Commission. In some areas, farmers mow and harvest the Bromegrass, Western Wheatgrass and Alfalfa mixtures. State Highway forces bale limited quantities of hay which is used for mulching regraded and reseeded sections of highway. Kansas plans to salvage more valuable mulching material from the roadsides this summer.

Engineers and landscape architects familiar with seeding operations realize that Kansas highways are receiving protective vegetation at a nominal price. Compared to information received from several other State Highway Departments, seeding and mulching costs are lower in Kansas. Reduced costs can be attributed to: (1) The use of farm type drills, discs and cultipackers which contractors operate efficiently; (2) the ability to get stands of grass using lower rates of fertilizer than many states find practical; and (3) the availability of wheat straw or old prairie hay from local sources at moderate prices.

Maintenance operations for such items as cleaning silted ditches and reshaping rutted shoulders are greatly reduced where soils are stabilized with good vegetation. Cars that might run off onto shoulders have a good chance to get back on the pavement without mishap where protective turf is growing. The many miles of vegetated shoulders and slopes not only enhance the appearance and improve the safety of the highway but also contribute in making motoring more pleasurable on Kansas highways.

SAW MILL SAVES CITY $20,000 A YEAR

A SAVING of $20,000 a year is enjoyed by the citizens of Kansas City, Missouri, because of one piece of city equipment, a sawmill.

The whole idea took form when the city realized it was getting nowhere with its problem of disposing of the trees that had to be removed for street or utility right-of-way construction. Almost all the trees were elm. They couldn't be used for lumber, nor, it was said, burned as firewood. But something had to be done. It was costly to haul the trees away and burn them and very difficult to find a place where that could be done.

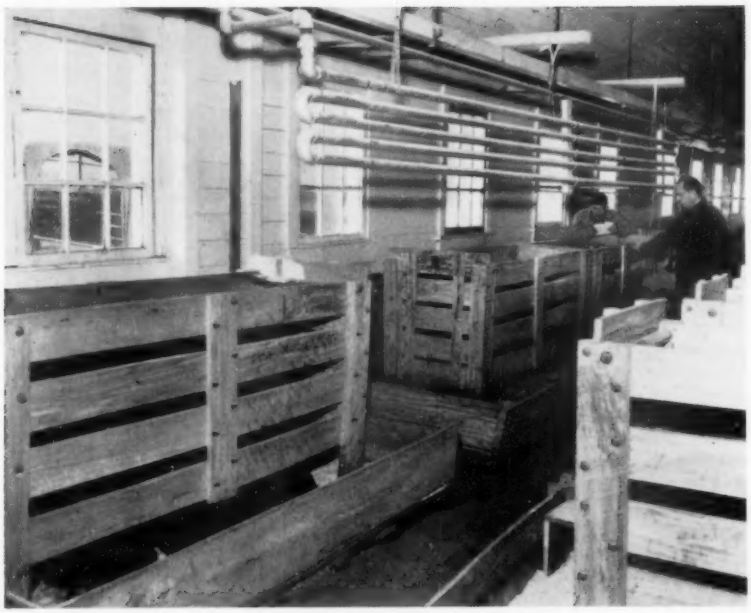
Finally, the late Martin Chaison, at that time city forestry officer of the Kansas City public works department, mentioned the problem to Cyriel Provyn, city superintendent of penal institutions, and Dr. Hayes Richardson, welfare director. The three men decided to try using some of the trees as firewood at the Municipal Farm where inmate help was available to cut the trees into logs.

"We tried to saw the logs by hand," Provyn recalls. "Then we tried to split them with steel wedges. We even tried to blast some logs with black powder charges.

"Somehow, we cut enough firewood that first year to save $6,500 on the fuel bill at the farm, and we had a surplus. We advertised for bids, but none of the wood dealers were interested. They said nobody wanted elm firewood.

"They were wrong about this,

● **CUTTING cordwood—fast. Limbs and small branches are converted into cordwood. Chute at the right delivers the pieces into trucks for delivery.**



● **KANSAS CITY'S municipal farm specializes in raising several thousand hogs annually. Lumber sawed from logs formerly wasted is now used to build pens.**

however, because when we began to offer the wood direct to homeowners — we found we were in the wood business. We have received so many orders and repeat orders since, at $15 for a full cord, we haven't been able to catch up."

Sawmill at Work

About this time the city authorized the purchase of a small cutoff-type saw, but listened attentively when it was pointed out that a sawmill would convert the better logs into lumber readily usable around the 1,000 acres worked by the inmates of the farm. Finally, a sawmill was purchased from the Belsaw Machinery Company of Kansas City. A portable model, it could be operated by one man.

The day the sawmill was set up at the farm, there was one thing missing — an experienced sawmill operator. That very evening, however, a friend called Mr. Provyn and asked if he had any jobs open. Provyn said he did — he needed a sawmill man.

"That's just what my friend is!" the caller said.

The new man, Ray Dixon, had had twenty-six years experience in Canadian sawmills. He qualified through the city merit system and was employed at the farm as a work supervisor assigned to the mill.

Lumber and wood production at the farm really began in earnest then. Trees removed by the city were trucked to the farm in park department or public works department trucks and unloaded on a slope above the mill. In addition to logs for firewood and lumber for construction at the farm, the mill began to produce posts for retaining fences on Kansas City parkways and heavy wooden blades with which park department trucks and tractors clean streets of leaves.

Then last spring, the entire operation came to an abrupt halt when the mill caught fire and was destroyed. The delay was only temporary, however, for the city purchased a new sawmill, also from the Belsaw Company. This mill was equipped with a 60-inch IP blade and powered with a 110-hp Allis-Chalmers engine. Heavier rollers and a heavier front end for the carriage were devised to cope with the unusual irregularity of the logs.

An underswing saw was fitted at the end of the rollers to speed the cutting of cordwood, and a chute was built to pick up the wood and drop it into waiting trucks. With these improvements, Mr. Provyn predicts it won't be long before the backlog of wood orders will be filled.

And there's little doubt he is right. Hundreds of cords of wood have been produced to supplement coal in the boilers of the farm, and other hundreds of cords have been sold to homeowners.

Up on the hilltop at the farm there's another project which has benefited greatly from the sawmill. It's the "pig factory" where last year 8,000 pigs were raised. Much of the elm lumber has gone into expansion of these hog raising facilities, and even the sawdust from the mill has fitted into the hog operation. The hogs are raised on concrete and the sawdust is used as bedding.

So a Kansas City problem has been solved by the purchase of a sawmill — and money saved in the bargain.

● **UNTIL this sawmill was installed, it was difficult to find a place to burn the trees cut in street widening work. Now the trees are cut into lumber at a profit.**

SIMPLIFIED

SLUDGE HANDLING AT LOWER COST

EUGENE H. TRUBNICK

Sanitary Engineer, Komline-Sanderson Engineering Corporation, Peapack, New Jersey

THE DISPOSAL of the sludge collected in primary and secondary sedimentation or clarification units is among the more expensive operations in the treatment of sewage, from the standpoint of capital investment, operating cost and operating and maintenance "headaches". Land costs money; structures cost money; heat costs money; and power costs money. Furthermore, sludge disposal appears to be one of the most troublesome operations in sewage treatment, as evidenced by the fact that the bulk of the discussion time at Plant Operators' Forums sponsored by the various State Sewage and Industrial Waste Associations is devoted to the problems encountered in treating and handling the sludge.

Any development that minimizes the costs as well as the operating problems of sludge handling contributes materially toward accelerating the fulfillment of the nation's waste treatment requirements. Vacuum filtration of fresh or raw sludge, as a result of recent developments in equipment and techniques, now affords the means by which sewage treatment can be provided at lower cost and by which simplified plant operation can be achieved.

Vacuum dewatering of fresh undigested sludge is by no means an innovation in waste treatment practice. Fresh activated sludge has been vacuum filtered at Milwaukee since 1925; fresh primary sludge has been dewatered on vacuum filters at Perth Amboy, N.J., since 1935; and in the same year Dearborn, Michigan, began the vacuum filtration of fresh chemical precipitation sludge.

At present there are in operation upwards of 34 sewage plants dewatering fresh sludge. These plants are distributed over 14 states. At least nine other plants which are now under construction plan to filter undigested sludge. The following is a break-down of the number and types of fresh sludges currently being dewatered on vacuum filters: Primary sludge only, 12; primary and activated sludge, 3; primary and trickling filter, 5; primary and garbage, 1; chemical precipitation, 6; chemical precipitation and activated sludge, 1; chemical precipitation and trickling filter, 1; and activated sludge only, 5.

In twelve of these plants the dewatered sludge is disposed of by sanitary fill or other methods of disposal into the ground; eleven plants incinerate; and in eight cases the sludge is dried for use as a soil conditioner, etc.

For some time filtration of fresh sludge was a troublesome operation, because of the presence in the sludge of colloidal material and greases which tended to clog and "blind" the filter media. Another interfering factor was the non-homogenous nature of the sludge. These problems have been overcome, however, with the coil spring type filter media which is non-clogging.

Vacuum filters are designed on the basis of capacities that can be expected with the type of sludge to be dewatered. These capacities are determined by filtration rates attained with the various sludges. Although sludges vary greatly in filtration characteristics that stem from many factors, operating experience has produced sufficient data to establish criteria for the design of vacuum filter installations for the various types of sludge encountered. Table 1 shows a comparison of the design criteria that were commonly in use twenty years ago, as reported by Fischer (1), with the criteria used today.

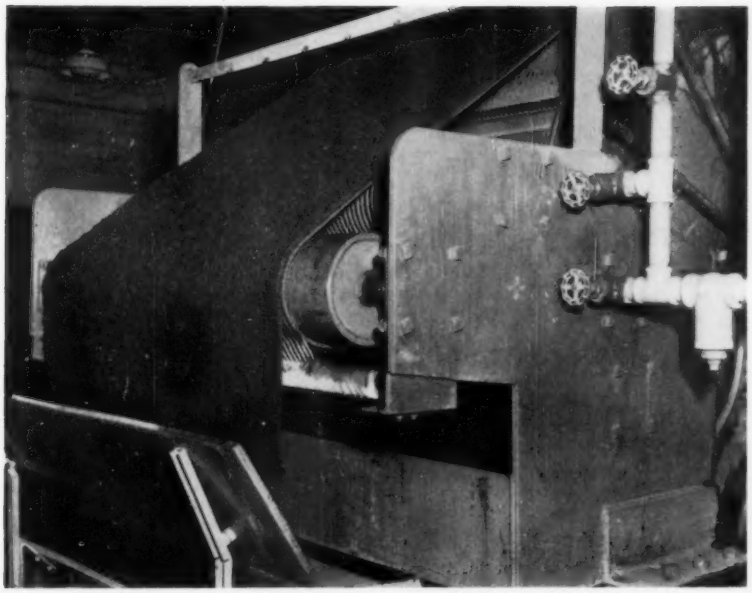
It is seen from this tabulation that

Table 1—Comparative Filtration Rates, Fresh and Digested Sludges

	Filter Rate — lbs./sq. ft./hr			
	1936 Standards		Present Standards	
Type of Sludge	Fresh	Ripe	Fresh	Ripe
Primary Only	5	6	8-10	6-8
Primary and Trickling Filter	4	6	7-8	6
Primary and Activated Sludge	4	2.5	6	5

Table 2—Results of Bidding, Sewage Treatment Plant Union City, Tennessee

	Contractor A	Contractor B	Contractor C
Alternate A. Furnish complete sewage treatment plant including digester and drying beds.	$367,900.	$406,900.	$385,600.
Alternate B. Furnish complete sewage treatment plant including vacuum filter and building.	$325,900.	$333,800.	$319,400.
Savings shown by Vacuum Filter	$ 42,000.	$ 73,100.	$ 66,200.
Percent Savings	11.4	18.0	17.2



● **HEAVY sludge cake, produced on this vacuum filter at St. Charles, Ill., illustrates the high filtration yields attainable in dewatering fresh sludge.**

advances in the field of sludge dewatering have resulted in general increases in the filtration rates that can be expected with the common sewage sludges. Rates attainable with fresh primary, fresh trickling filter and digested primary and activated sludges have doubled.

It is further noted that fresh sludges are more amenable to dewatering than the corresponding ripe sludges as long as a non-clogging filter media is used.

Lower Capital Investment

Initial cost of a treatment plant is the first consideration of the tax payer and of the governing officials when construction or expansion is being contemplated. Reduced construction costs constitute a potent factor in "selling" needed sewage treatment facilitates.

Table 2 shows the results of actual bidding on construction of a complete treatment plant for Union City, Tennessee, to serve a design population of less than 15,000. It is seen from this table that, on the basis of the bids received from contractors, a vacuum filter installation to dewater fresh sludge costs from $42,000 to $73,100 less at this plant than would a so-called "standard" plant, representing savings of 11.4 percent to 18.0 percent of the construction cost of the entire plant. Figure 1, for which data were collected from similar bidding and from several consulting engineers' independent evaluations, shows that savings in construction cost that can be anticipated by providing for filtration of fresh sludge range from $3.12 to $5.95 per capita, with an average of $4.00 per capita of design population. It is interesting to note that substantial economies are possible not only with large filter installations, but also with installations for communities with as low a population as 4,000.

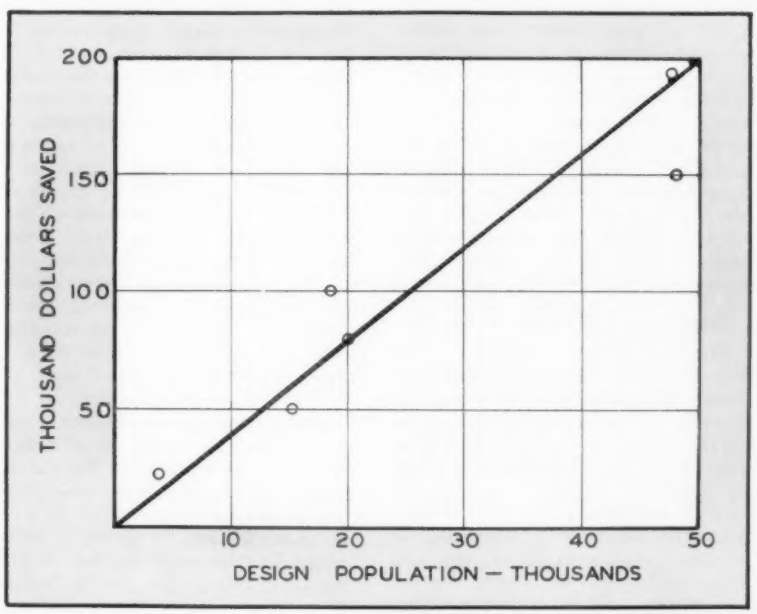
Operational Advantages

Operation of a vacuum filter on fresh sludge involves the same techniques as on ripe sludge, and is essentially a chemical and mechanical process, not involving any biological reactions. As such, the operation is not dependent on the activity of microorganisms and is thus not susceptible to upset by factors such as shock loads, temperature changes, etc. Dewatered cake from the vacuum filter is mechanically conveyed either to a dryer or incinerator, or to trucks for transport to a disposal area. In this type of operation manual handling of the sludge, such as is necessary with sand drying beds, is entirely eliminated and the labor involved in disposal is reduced to a minimum.

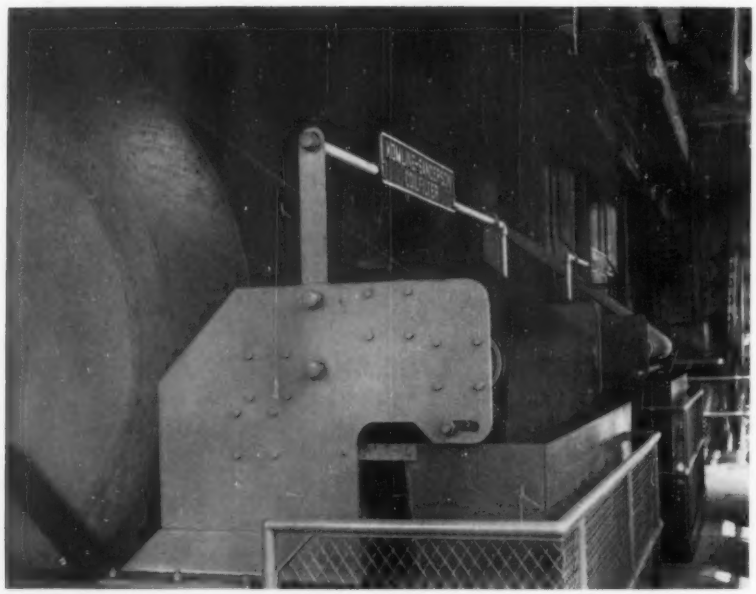
Not only are higher filter yields attainable with fresh than with ripe sludge, as has already been pointed out, but the chemical dosages required per unit of sludge solids for conditioning purposes are considerably less with fresh sludges. This is essentially due to the fibrous nature of the settled sewage solids.

The efficiency of the liquid phase of a sewage plant is enhanced by virtue of the ability to remove settled solids from the sedimentation devices at will, avoiding the possibility of creating septicity in the sludge and in the sewage. At some plants fresh sludge is pumped directly from the primary clarifiers to the filter equipment; at other installations a sludge holding tank, with a capacity of two or three days' production of sludge, is included in order to provide for week-end plant operation or for stand-by storage.

The lower installed cost of vacuum



● **CHART, Fig. 1, shows savings in construction cost by dewatering fresh sludge.**



● FRESH primary sludge containing large quantities of industrial waste is readily filtered at West Plant, Williamsport, Pennsylvania, on a 150 sq. ft. Coilfilter.

filters is reflected in lower fixed charges which constitute a considerable part of annual operating costs. This, and the decreased labor and maintenance requirements with vacuum filters balance the cost of the chemicals required for proper dewatering. The annual operating cost of a plant dewatering fresh sludge is, therefore, no greater and in many instances is actually lower.

Objections have in the past been raised to the potential odor nuisances that might result from the handling of fresh sludge. The lime used in conditioning the sludge neutralizes the acidic constituents that give rise to these odors and, if introduced prior to exposure of the sludge to the atmosphere, eliminates odor nuisance even with septic sludges. Odors that occasionally emanate from sand beds, in contrast, are difficult to control, and can create considerable nuisance, especially when a sewage plant is situated close to residential areas.

Disposal of Dewatered Sludge

Disposal of fresh sludge by methods other than incineration has until now not been generally accepted, because of the possibilty of survival, in the sludge, or pathogenic organisms. Ripe sludge, on the other hand, is commonly used as a fertilizer or a soil conditioner. Yet precautions must be observed in disposing of digested sludge in or on the soil, since pathogenic organisms are not completely destroyed by the digestion process. Cram (2) and Muller (3) have found that eggs of Ascaris lumbroides and of hookworm can survive mesophilic digestion and subsequent air drying for as much as a year. Fuller and Litsky (4) have observed survival of E. coli in drying digested sludge for several weeks. In the disposal of ripe sludge, therefore, the possibility of the spread of pathogens is not completely eliminated.

Fresh sludge that has been dewatered on vacuum filters contains one to three percent of ferric chloride (based on the weight of dry solids in the sludge) and five to ten percent of lime, chemicals which are required in conditioning the sludge for efficient filtration. The suitability of the sludge as a culture media for the growth and survival of bacteria, etc., has been altered by virtue of the coagulating effect of the ferric chloride, and by the establishment of a highly alkaline environment that is a deterrent to the survival of pathogenic organisms. Investigations at Coventry, England, (5) have failed to isolate pathogens from fresh sludges collected at each of two treatment plants. Wilson (6) points out that exposure to the weather and to the action of soil organisms will reduce the pathogens that may be present in the sludge.

This does not mean that fresh sludge can be indiscriminately scattered on the soil or among growing crops. Caution must be used in disposing of this sludge, just as caution is necessary in the disposal of ripe sludge. Definitive work is in progress to determine the fate of pathogens in dewatered fresh sludge after disposal.

The potential hazard of communication of disease is greatly reduced, if not entirely eliminated, however, by other simple means of sludge disposal, such as in a sanitary fill. Sanitary landfill has been used for some time as a method of disposal of garbage and refuse, and when operated properly, this method of disposal creates no nuisance whatsover. In a recent investigation (7) of leaching of a sanitary landfill, the State Water Pollution Control Board of California concluded that where the pollutional load on a ground water is light by reason of a sanitary landfill being in intermittent and partial contact with the underlying ground water, the most serious impairment of the ground water as little as a half-mile downstream from the landfill will be an increase in hardness, and then only in the upper portions of the aquifer.

It was further concluded that if landfill is so located that no portion of it intercepts ground water, it will cause no impairment of the ground water for either domestic or irrigational use.

The writer has visited an installation at St. Charles, Illinois, where conditioned, dewatered fresh sludge has been disposed of by landfill, with a minimum of cover, since 1937, and has found no evidence of nuisance in the vicinity. The sludge apparently stabilizes rapidly enough so that the material quickly displays a uniform appearance and consistency.

It thus appears that with ordinary precautions, such as would be practiced in the disposal of any waste material, the disposal of chemically conditioned dewatered fresh sludge in the ground should not constitute any more of a health hazard or nuisance than the disposal of ripe sludge. In contrast to drying on sand beds, disposal of sludge by means of vacuum filtration followed by fill has the advantage of not being dependent on prevailing weather or climatic conditions.

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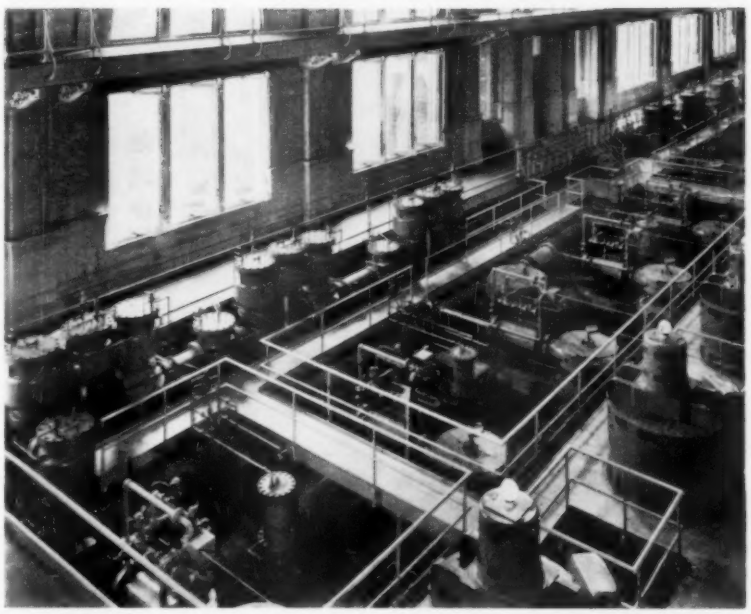
WATER PUMPING STATION HAS UNUSUAL FLEXIBILITY

THE Bryant Street Pumping Station in Washington, D. C., has been called "the most modern pumping station in the world." Once operated by steam power and equipped with both reciprocating and turbine driven pumps, the station has been completely rehabilitated since the end of the War. New pumps and motors have been installed; controls at the operator's station are placed on a color-coded diagram of the plant piping arrangement; and special provisions have been made to give the utmost flexibility of plant operation, both to handle current emergency demands and to care for the eventualities of future expansion in any of the service areas supplied.

Reconstruction started in 1946, with final tests being completed in early 1953. Ten new pumps were installed and one of the old units was retained. Throughout the reconstruction period certain sections of the plant remained in service, necessitating careful planning and coordination of all construction activities.



● **INTERIOR of the Bryant Street station. The spillage system extends along the length of the station and connects to distribution mains and high service pumps.**

Distribution from this pumping station is through four separate service systems, arranged according to the elevation of various parts of the city. Low service covers those sections with ground elevations of 0 to 70 feet above sea level; the first high serves the 70 to 140-foot section; second high reaches the 140 to 210-foot areas, and third high the 210 to 350-foot elevations. Low service areas are supplied by gravity flow direct from the clearwells of nearby McMillan Filtration Plant during periods of low flow. As demand increases, pressure is maintained by one or more of three low service pumps, each rated at 35 mgd at a 45-ft. head. Table 1 lists pump capacities and operating heads of each of the pumps installed in the station.

All pumps operate under a positive head since the pump centerlines are at El. 118 and the overflow from the McMillan Filtration Plant is about El. 160. Due to the arrangement of the pumps, all flow to the low service area must be served through the gravity system, or else the entire flow must be pumped.

The Spillage System

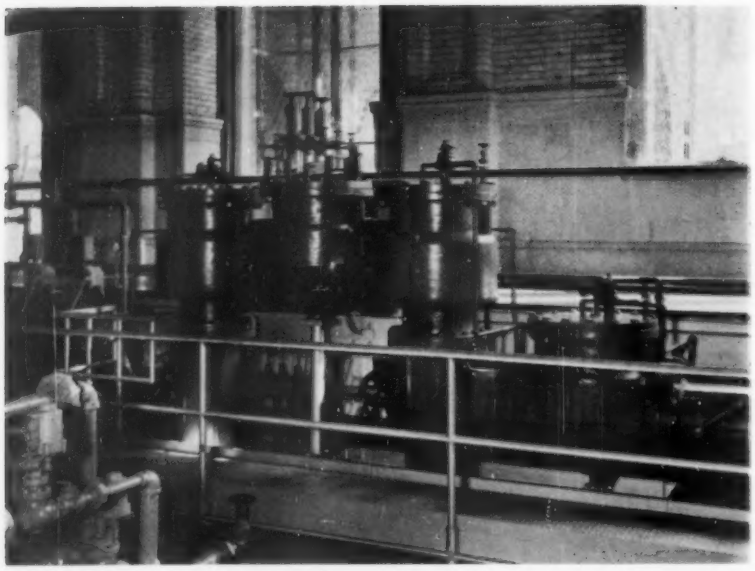
Unusual operating flexibility has been designed into the new station. In addition to the two or more pumps serving each portion of the distribution system, provision has been made to transfer flows from any high service to a lower one. This is accomplished by a series of valves and pressure regulators combined in a transfer header which connects to each of the four service grid discharges. These valves, regulators and accompanying piping are referred to at the plant as the "spillage" system. A total of 21 Golden-Anderson 16-inch Flowtrol valves are used to control flow into and out of the system, with seven Golden-Anderson pressure regulating valves providing necessary control of delivery pressures to the various services. The Flowtrol valves are arranged in such a way that the need for elbow fittings is eliminated. These valves are operated by introducing water pressure from the upstream side of the valve to an operating cylinder by means of a small plug-type pilot valve. This pressure opens the valve to full pipe line flow, or closes it drop-tight. A needle valve regulates speed of valve closing. Thus the 16-inch valves may be operated without effort by one man.

Table 1—Pumps Installed at Bryant Street Pumping Station

Service	*Ground Elevation*	*Pumps*	*Capacity*
		3	35 mgd @ 45′ head
Low	0 - 70 ft.	3	35 mgd @ 110′ head
1st High	70 - 140 ft.	2	25 mgd @ 210′ head
2nd High	140 - 210 ft.	2	15 mgd @ 310′ head
3rd High	210 - 350 ft.	1 (old)	20 mgd @ 310′ head

Spillage Pressure Regulation

The key to the system is the series of pressure regulating valves. These



● **CLOSEUP shows two Golden-Anderson angle-body Flowtrol valves with a pressure regulating valve between them. To the right is a globe pattern Flowtrol valve.**

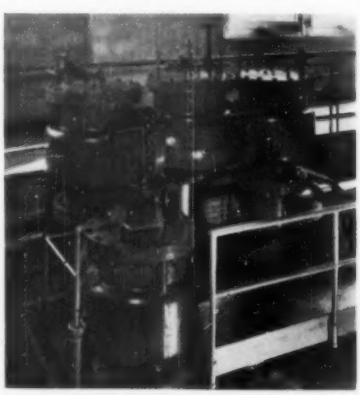
are set for predetermined delivery pressures, and are fitted with one, two or three sets of regulating controls placed in parallel to govern discharge pressures into the different service systems. Thus a pressure regulating valve receiving flow from the first high service has one pressure control, since this can discharge only to the low service. Valves delivering water from the second high service have two pressure controls to regulate flow pressures to either the first high and low services, and similarly, valves from the third high service have three pressure regulating controls. In addition, certain of the valves are fitted with pressure relief controls so that flows at excess pressure are relieved automatically to the spillage header and thence to lower service distribution grids. Basically the same type of control is used for both pressure regulation and relief, with the controlling pressure coming from the downstream side of the valve for pressure regulation and from the upstream side for operation as a relief valve.

The Flowtrol valves in the system are arranged with an angle-body valve on each side of a pressure regulating valve to control flow to this unit, plus alternately placed globe pattern Flowtrols to permit discharge directly to lower services without passage through the regulating valves or to isolate a pressure area station. In the accompanying illustration, it can be seen that these angle body and globe pattern valves permit an exceedingly compact arrangement and eliminate many tees and ells.

Ready for the Future

By use of this spillage system, excess demands on lower service lines can be cared for readily. At present, the spillage system is not regularly used. However, no matter how carefully the future demands of a water distribution system may be calculated, there is always a large measure of uncertainty in predictions of actual requirements at some future date. Unforeseen development of certain areas may distort the anticipated flow pattern. Thus the spillage transfer system may be regarded both as insurance to handle temporary emergency demands and as a safeguard against the demands of the future.

Many provisions have been made



● **PRESSURE regulating valves are preset for desired spillage pressures.**

to handle emergency conditions, among them being an arrangement which automatically closes the cone valves on each pump discharge in the event of power failure. Water pressure does the work, and controls are operated by solenoids. The pump discharge cone valves are hydraulically operated by pressure from the second high service. If power fails while a pump is running, two solenoid valves operate automatically. One closes the main control line from the second high service while the other opens to transfer water from the first high service to the hydraulic cylinder. This closes the pump discharge valve approximately 90 percent in ten seconds. By this time the flow of water through the pump will have reversed itself, but as the pumps are designed to allow rotation in the opposite direction, no harm is done. The return flow from the mains, now diminished in quantity by the throttling action of the nearly closed valve, passes through the intake piping to the filter plant clearwell, which acts as a sump. Complete closure of the cone valve is accomplished more slowly. Following the initial 90 percent closing, a linkage on the cone valve position indicator shuts off the rapid flow of operating water to the hydraulic cylinder and opens a parallel circuit in which flow is controlled by a needle valve. This secondary flow completes closing the valve over a period of about five minutes. By means of this double control system it is possible to shut down safely without danger of excessive surges in the distribution system or the piping of the pumping station. This set-up has proven its worth on two occasions, once when a single pump was running and once when five pumps were on the line.

In the District of Columbia, the Corps of Engineers is in charge of water supply and filtration, while the District handles distribution, including pumping. Pumping load from the Bryant Street Station is shared by the Dalecarlia Station. Claude Sizemore, Deputy Superintendent, Water Operations Division, is in charge of the Bryant Street Plant. Paul Lanham is Superintendent of the Water Operations Division, Department of Sanitary Engineering, District of Columbia. Consulting engineers for the rehabilitation of the Bryant Street Station were Greeley & Hansen, Chicago, Ill. During this rehabilitation work, the resident engineer for the Corps of Engineers was Wm. T. Van Doren. Assistant resident engineer was Guy B. Watson, Jr.

LOW COST, DUST FREE ROADS

HENRIK E. STAFSETH

Engineer-Manager

Board of County Road Commissioners

Ottawa County, Michigan

● **COMPACTING the base course gravel. Calcium chloride is applied to aid in compaction. Prime and double seal coat should be constructed immediately.**

FOR THE past 20 years the Ottawa County Road Commission has been constructing low-cost, dust-free roads. These can be described briefly as a bituminous prime and double seal coat surface on 7 inches of gravel base with a 12-inch sand sub-base and adequate road drainage. It may be felt by some people that a road constructed according to our specifications is not a cheap road; however, it is the feeling of the writer that good road drainage and base construction are two items of design which cannot be cheapened in any way. The road surface can be selected from a variety of materials, if the base construction and drainage are well designed. With adequate base and drainage construction, cheaper surfaces will give service without unreasonable maintenance costs.

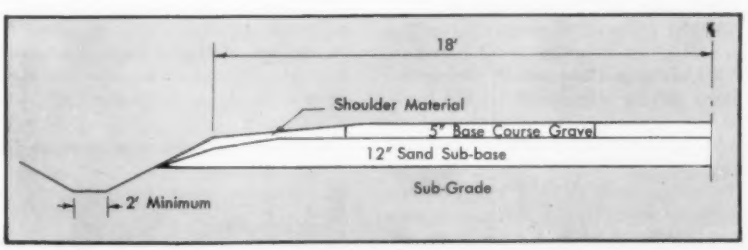
Ottawa County has an annual snowfall of just below 60 inches, but about once in five years, there is over 60 inches of snow. The frost will penetrate about 3½ to 4 feet. Soil conditions vary greatly; along Lake Michigan there are sand dunes, but inland a few miles, we have light sandy soil. The eastern half has heavy clay soils. However, there is a smattering of sand hills scattered throughout the clay soil districts. We seldom have to haul sand for sub-base construction more than three miles; the maximum haul to a construction job seldom exceeds 10 miles for pit run gravel. There are 17 Townships covering 564 square miles. The County Road System is composed of 363 miles of Primary or Main County Roads and 1030 miles of Local Roads which were formerly the Township Roads.

Design and Construction

Some 20 years ago our County Road Commission, following the recommendations of their County Engineer, adopted the policy that all roads constructed on heavy soils will be designed with at least a 12-inch sand sub-base. The use of the minimum 12-inch sub-base has eliminated frost heaves. Since the design of a road section on a sandy soil with a low water table does not present any road base construction problem, my discussion will be confined to design and construction on heavy soils.

The typical section for heavy soils is shown herewith. The subgrade is shaped and constructed to a 40-ft. width with a 4-in. crown. This is done so that any water finding its way into the sand sub-base will readily drain to the side ditches. The side ditches are constructed as follows: Starting at the edge of the subgrade, there is a 1 on 2 slope to the bottom and all ditches have a minimum depth of one foot and a minimum bottom width of two feet. The back slopes are also constructed on a 1 on 2 slope. The ditch sections are designed with sufficient capacity so that the elevation of the water in them will not rise above the subgrade and penetrate into sub-base. Sometimes it is necessary to design independent or larger ditches to maintain the water elevation below the surface of subgrade.

A sand sub-base of a minimum thickness of 12 ins. is placed on the subgrade 37 feet wide. During the construction of the subgrade and the placing of the sand sub-base, care is taken to maintain a smooth subgrade; there should be no variation in the designed subgrade cross section of more than one inch. It is important that water is not pocketed in the subgrade and with the designed crown it will seep to the roadside ditches. On top of the sand base is placed 5 inches of pit run gravel to form the gravel base course, and



● **TYPICAL one-half section of finished road constructed on 40-ft. width.**

this is constructed to a 24-ft. width, leaving a 6½-ft. wide strip on either side of this gravel course. Following the placing of the gravel base course on the sub-base, the edges of the sand sub-base are feathered out to the edge of the subgrade so that the sand base at the edge of the roadbed has a thickness of approximately one inch.

After the sand sub-base has been feathered out to the edge of the subgrade, shoulder material is placed over the sand sub-base from the edge of the subgrade to the edge of the base course of gravel, as shown in the drawing on the preceding page. The shoulder material used in our County is composed of shoulder clippings or ditch clean-out material taken from one of our lesser traveled local roads adjacent to the new construction project. By doing this, we accomplish two tasks: first we provide ourselves with shoulder material that will grow grass quickly; secondly, we clean out ditches and clip shoulders on local roads, a job that could not be done otherwise because of lack of funds.

Second-Year Procedure

This first stage of our construction can be done in the first year, and the balance can be completed the following year if so desired. The second year, we place two inches of processed gravel over the base course gravel to the full width of 24 feet; also 4 tons of calcium chloride per mile is applied to the processed gravel to aid the compaction of this material. The gravel surface of the road is then bladed and floated to a 3-inch crown, care being used to attain as smooth of a surface as possible. One thing to remember is that, when the road reaches its point of greatest compaction and has the desired shape, a prime and double seal should be placed immediately.

We have found, in placing our prime coat on a gravel surface, that a slight amount of moisture in the gravel gives a better bond between the gravel and the prime. On occasions during dry weather, we have had to sprinkle the gravel surface with water to obtain the compaction and get the desired penetration of the prime coat. A field test that we used to determine if there is excessive moisture after a rain is to pat the gravel surface with the foot several times, and if a shiny film doesn't appear, the surface is ready for priming. Also it should be noted that before the gravel surface is primed, all loose material should be brushed off the surface.

The balance of the operation to complete the prime and double seal is basically the same that is used in many places. We use at least 0.3 gal./sq. yd. of T-3 tar for prime and sometimes more if the surface will absorb it. For the two successive single seals we apply MC-5 asphalt at the rate of 0.3 gal./sq. yd. and use 25 pounds of chips or pea stone. The prime and double seal coats that have been placed, are 20 feet in width.

The additional width of base course gravel of two feet on each side of the metal has been a very good investment for it strengthens the edge of the prime and double seal coat. From experience, it has been noted that if the prime and double seal is applied to the full width of base course gravel, a great deal of edge breakage is encountered. The experience of the past 20 years in this County in edge breakage with the additional width of gravel base has been negligible.

Service Experience and Cost

The service experience of this type of road construction has been outstanding. The patching on these roads has been held to an absolute minimum. Any time that excessive patching in one location has been noted, on checking the sand sub-base at these locations, it is always found that some frost heave material had gotten in the sand sub-base material when it was placed. It is for that reason that the sand base material used is limited to a minimum of 5 percent clay or silt and this is strictly adhered to through close inspection.

The pit run gravel in Ottawa County used for base course gravel has a tendency to be low in percentage of soil binder. This low percent of soil binder in the gravel helps to reduce the moisture retained in the gravel base course which reduces the heaving effect during the freezing and thawing weather. Using a width of 20 feet for the metal, as against a narrower width, it can be noted on inspection of these roads that very little shoulder maintenance has ever been done. Apparently the traffic has been confined to the metal surface. The shoulder clippings that were used for the shoulder material has developed into good sodded shoulders. These sodded shoulders have proved to be very stable and have possibly contributed lateral support to the base course gravel.

In addition to the saving in maintenance by construction of adequate drainage and base, this type of construction elevates the road surface above the surrounding lands. This has been very helpful during snowstorms, because the snow is blown off the road surface to the sides.

The cost of constructing this type of dust-free road currently averages about $16,000 per mile. This includes the cost of grading, placing the sand sub-base, the gravel base, the second or processed gravel layer, chloride, and prime and double seal coat complete. However, it should be noted that the cost does not include any unreasonable tree removal and that the grading was performed on generally flat and light rolling country side. In the first part of this article, it was pointed out that the sand and the gravel for the sub-base and base course, respectively, are available without excessive hauling.

This type of construction is very flexible; it has taken care of our basic requirements in that the drainage, base construction, and width are adequate. It is a simple matter to just apply a higher type of metal, such as a bituminous aggregate surface course, which can be laid on top of the existing metal without additional work. This demonstrates the basic problem: that there is no substitution for quality and that quality is actually economy.

The writer would like to pay tribute to Carl T. Bowen, the former Engineer-Manager of the Ottawa County Road Commission and his Assistant Engineer, William Osner, who have contributed the information and the history in regard to the development of these roads. It may be further stated that these two Engineers were the originators of the design of this road section.

● **SHOULDER clippings in place for two months: note good stand of grass.**

THE USE OF PHOTOMETRIC INSTRUMENTS for COLORIMETRIC ANALYSIS OF WATER AND WASTES

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JUST 100 YEARS AGO, in 1856, Julius Nessler described the first colorimetric method of chemical analysis—a method for the determination of ammonia that, with only slight modifications, has remained the standard method for determining small quantities of ammonia in water up to the present day. The great sensitivity of this analytical method led to its rapid adoption by chemists all over the world and added new terms to our language. We speak of Nessler reagent, nesslerize a solution for ammonia determination, and use Nessler tubes for the comparison of colors.

Colorimetric methods of analysis depend upon the transformation of the material to be determined into some colored compound followed by a comparison of the intensity of the color produced with the depths of color obtained by subjecting solutions containing known quantities of material to the same procedure. Usually the only steps required are the addition of the appropriate reagent or reagents to the unknown solution and to suitable standards followed by a comparison or matching of colors. As a result colorimetric methods of analysis are frequently quicker and easier to carry out than other methods.

Colorimetric analysis may also be very sensitive—that is, extremely small concentrations of material can be determined. In some instances concentrations of one part of material in a billion parts of water are measurable. The Nessler method for ammonia is so sensitive that smoking in the laboratory where the test is being carried out will cause errors because of the tiny amounts of ammonia in tobacco smoke.

The speed and sensitivity of colorimetric analyses make them particularly valuable for water and wastewater analyses, in which multiple samples must often be analyzed for minute concentrations of numerous substances. Because of these advantages a great number, perhaps a majority, of the chemical analyses described in the latest edition of *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes* are colorimetric ones. The determinations of iron, manganese, and other trace metals, of available chlorine, fluoride, phosphate and of all the forms of combined nitrogen are a few examples of analyses that fall in this category.

However, there are a number of disadvantages to colorimetric analyses. Because the eye is able to distinguish only relatively great color differences, simple colorimetric analyses are not very accurate. Ordinarily results are good only to ten or twenty percent and may be even more in error.

The need of standards for color comparison also presents a problem. For some analyses the color standards are stable and so may be prepared once and then used for a year or more; with others the colors tend to fade or change color fairly rapidly so that new standards must be prepared each day or even for each analysis. This is a nuisance and is time-consuming. This problem has been solved to some extent by the development of colored glasses that imitate the color of the standards or of stable colored solutions that match those of the unstable standards, as in the instance of the standards for available chlorine. They are only a partially satisfactory solution for the substitute color standards only rarely, if ever, exactly match those produced in the analysis.

A third difficulty is that the use of the eyes for determination of a color match is subject to personal bias. The analyst usually has some idea of the kind of result he would like to find and as a consequence sometimes is unconsciously led to see a color match with a standard where there is none, or *vice versa*.

About twenty to twenty-five years ago the commercial development of light sensitive photoelectric tubes and barrier-layer photocells made possible more impartial methods for the measurement of light. More recently they have been joined by the ever more sensitive photo-multiplier tubes. All of these devices when connected in appropriate electrical circuits are able to convert light energy into electrical energy, which can then be measured by means of galvanometers, potentiometers or other similar electrical measuring instruments. It thus became possible to use sensitive electrical devices for the reliable measurement of light intensity without bias. The light meters used in photography are simple examples of this conversion and measurement.

Although the measurement of light intensity can be made more reliable by the use of photocells or photo tubes, this in itself is not sufficient for the determination of color intensity in chemical analysis, because the swing of a galvanometer does not discriminate among colors. What is needed is some method for separating the various colors so that their separate intensities may be measured. To see how this has been done the nature of ordinary light and the behavior of colored subtances in relation to light must be considered.

The Nature of Light

Ordinary light, like that from the sun or from an electric bulb may be considered to be composed of traveling waves, like the ripples in a pond when a stone is thrown in. But the ripples in the pond are just a simple set of waves, whereas the light energy from the sun is composed of rays of all different wave lengths — distances from crest to crest of the waves. Those rays to which the eye responds have wave lengths from about 400 millimicrons (mμ) or 16 millionths of an inch to about 700 millimicrons (mμ) and so the continuous band between these

limits makes up what is called visible light.

The different wave lengths of light produce different color sensations when they strike the eye. Light near 400 millimicrons is violet; at increasing wave lengths the colors trend gradually through blue, green, yellow and orange to red at 700 mμ. Thus the wave length of a beam of

● FIG. 1a—VISIBLE SPECTRUM. White light, passed through a prism or diffraction grating, is shown to be made up of a continuous band of radiation comprised of all visible colors.

light is a specification of its color. The continuous mixture of light rays of all colors or wave lengths in the proportions they are found in the light from the sun is what is called white light.

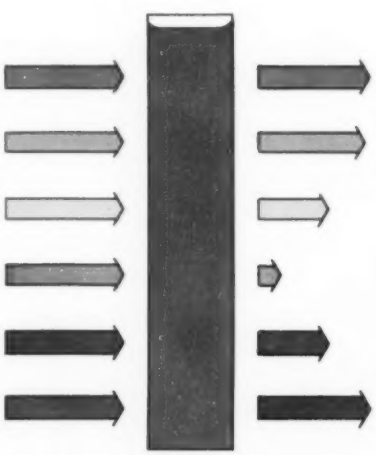
When a beam of light is passed at an angle through a triangular wedge of glass or other transparent material (a prism) it is bent or refracted as it crosses the surfaces between the glass and air. This bending is greater the shorter the wave length of the light, and so the light coming out of the prism is spread out into a band or spectrum according to the colors that made up the initial light. A typical spectrum produced by white light as shown in Figure 1a displays all the colors in the wave length range from 400 to 700 millimicrons. The rainbow is just such a spectrum, produced by the refraction of sunlight through the raindrops, which act like prisms.

Color and Light Absorption

The color exhibited by substances or solutions viewed in ordinary light results from the absorption of a portion of the light as it strikes or passes through the solution. If a solution absorbs all of the wave lengths of light except those in the neighborhood of 700 millimicrons then it will appear deep red for the wave lengths corresponding to this color are the only ones that get through the solution to affect the eye. With a permanganate solution, as shown in Figure 1b, the familiar reddish-purple color is produced because the permanganate absorbs strongly the yellow and green wave lengths while the remaining wave lengths pass through the solution relatively unaffected. In a general way the wave lengths of light absorbed by a colored solution are those complementary to the observed color. Thus a green-colored solution may be expected to absorb red light; a blue one orange or yellow light; and an orange one the wave lengths corresponding to blue light. Depth of color is generally related to the fraction of the light absorbed and thus for a solution, color depth is related to its concentration since the more concentrated solutions of colored substances are, the greater the fraction of the light they absorb.

The Absorption Spectrum

More detailed information about the absorption of various wave lengths of light by a colored material may be obtained if the light is first separated into its spectrum and then the fraction of the light absorbed at individual wave lengths throughout the spectrum is measured. In this way a series of numbers representing the fraction of the light absorbed at each wave length can be obtained. More frequently it is the fraction of the light not-absorbed, the *transmitted* light, that is directly measured. This is usually put on a percentage basis and given as *percent transmittency*. When the percentages of light transmitted or absorbed at each wave length are plotted as a function of the wave length an *absorption spectrum* for the solution is obtained, such as that shown in Figure 1c for a dilute solution of permanganate. Results like those in Figure 1c for a standardized unit concentration and length of light path through the solution constitute an absorption spectrum that is characteristic of the dissolved substance and may be used for identification purposes.



● FIG. 1b—COLOR AND LIGHT ABSORPTION. Colored solutions absorb light complementary to the observed colors. The violet-red color of permanganate solutions are the result of absorption of green and yellow light.

Methods of Photometric Analysis

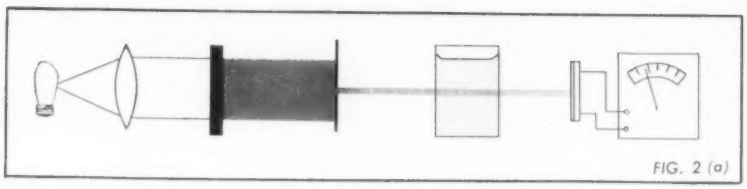
It is apparent from an examination of Figure 1c that a permanganate solution is most efficient in the absorption of light of wave lengths near 525 millimicrons. At this wave length an observable change in light intensity would occur for the smallest concentration

● FIG. 1c—ABSORPTION SPECTRUM. By dispersing white light into a spectral band and then measuring the fraction of the light transmitted by a colored substance at each wave length an absorption spectrum is obtained. This illustrates the absorption spectrum for a 10 ppm potassium permanganate solution, 2 centimeters deep.

of permanganate. A sensitive method for the measurement of manganese as permanganate would then be available by isolating light of a narrow wave length region near 525 millimicrons, passing it through the permangante solution and measuring the fraction of the light transmitted.

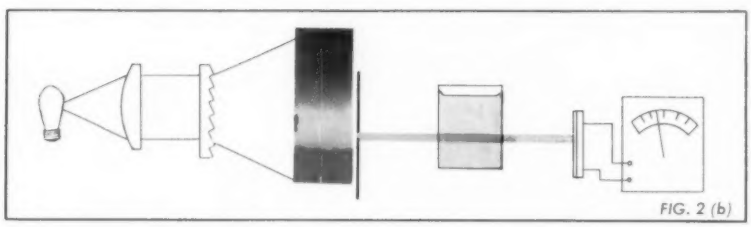
This is the general technique involved in instrumental photometric analysis. The essential features of any such photometric instrument are: (1) a source of continuous visible light of constant intensity; (2) a device for isolating light of the desired wave length region from the continuous spectrum—*a monochromator;* (3) sample holders or cells in which the solution is placed and through which the monochromatic light passes; and (4) a light receptor that converts the energy of the light passed through the solution into electrical energy and provides some means for measuring the electrical energy produced.

Schematic drawings of these essential units are shown in Figure



● **FIG. 2a—FILTERS. White light, focused to a parallel beam, passes through a filter that absorbs all but the required color. A slit selects a narrow beam which is partly absorbed by the sample. The unabsorbed portion of the colored beam hits a photocell, yielding an electrical impulse that is measured by a galvanometer.**

2, which illustrates more particularly the three general ways in which light of the desired narrow wave length range is obtained for passage through the sample. In the simplest of these ways, shown in Figure 2a, the white light is passed through an appropriate colored glass or filter that absorbs all but the light of the desired wave length region. While this is a sample technique, the filters do not generally provide precise isolation of wave length—wave bands about 30 to 40 millimicrons in width are usually obtained—and only wave bands at intervals, depending on the number of different filters available, can be obtained. Instruments using this



● **FIG. 2b—GRATING. White light is collimated and passes through a diffraction grating that spreads the light into a spectrum. An appropriate wave length is selected by a slit; this monochromatic light passes through the sample. The unabsorbed portion of the beam strikes a photocell and light intensity is measured.**

type of wave length isolation are called filter photometers. They are often highly satisfactory for routine analytical purposes, though usually not for intensive research.

In spectro-photometers collimated light is either diffracted by a diffraction grating as shown in figure 2b or refracted by passage through a prism as illustrated by Figure 2c to produce a complete spectrum of the light. Then a narrow slit is used to select the desired wave lengths for transmission through the sample. Ordinarily the slit itself is not moved to provide selection of different portions of the spectrum, but rather the prism or grating is rotated or the light source is moved so as to pass the various portions of the spectrum in front of the slit. With the spectro-photometer, then, it is possible to select any desired wave length and such instruments are therefore more versatile than filter photometers.

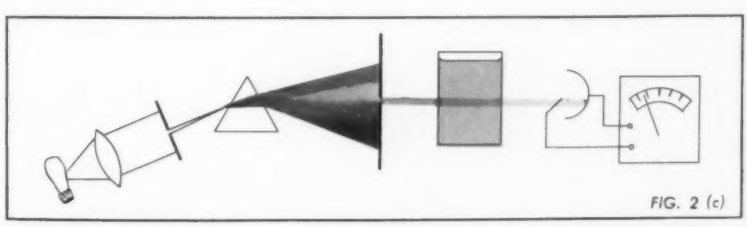
The chosen beam of light, after passing through the absorption cell is caused to fall on the surface of a photo-receptor, either a photo-cell or a photo-tube. In either event the light energy is transformed into electrical energy in proportion to the intensity of the light. The electrical current produced may be measured directly by a galvanometer or the galvanometer may be used as a null instrument in a potentiometer arrangement, the value of the resistance necessary to produce balance being measured.

For operation of any of the instruments the technique is essentially the same. After the instrument has been turned on and the proper wave length has been selected, a sample cell containing a *blank* solution, either plain water or a solution resembling the actual sample except that it contains none of the substance to be determined, is placed in the light beam. The amount of light from the light source is then adjusted until the galvanometer reads 100 or until the galvanometer balances with the adjusting resistance set at 100. Then the blank cell is removed from the light beam and a matching cell containing the sample is introduced. The reading of the galvanometer or the resistance necessary to produce balance represents directly the percentage transmission of the sample as compared with the blank.

Thus in instrumental photometry the galvanometer reading of percent transmission of light takes the place of the recognition of a color match of visual colorimetry. The instrumental method is fundamentally more sensitive than the visual one for it utilizes just that portion of the light spectrum that is most strongly affected by the material being determined, rather than the whole range from 400 to 700 millimicrons. It is also more rapid, particularly for a series of determinations of the same substance, for individual series of standards do not need to be prepared for each set of determinations and only a single reading is required rather than a number of comparisons to find the proper match.

Advantages

One of the big advantages of instrumental photometry over visual colorimetry is the gain in accuracy. Even the simplest filter photometers can provide results that are good to 2 or 3 percent as compared with 10 or 20 percent by visual methods. There is obviously a gain in objectivity as well. It is often possible to carry out photometric analyses in the presence of obscuring colors of other hues, just because of the selectivity of these methods with respect to wave length regions used. Visually such analyses are extremely difficult or impossible.



● **FIG. 2c—PRISM. A narrow beam of focused white light is selected by a slit and spread into spectrum by refraction on passing through a prism. An appropriate wave length, isolated by an adjustable slit, is partly absorbed on passing through sample. The residual beam strikes a phototube and amplified impulse is measured.**

Light Absorption and Concentration

In order to convert photometric readings of percent transmission of light into concentration of substance being analyzed, it is necessary to have a calibration curve relating these two quantities. This is usually done once and for all by preparing a series of solutions containing known concentrations of the substance in question, treating these known solutions with the appropriate reagents just as an unknown sample would be treated and then measuring the light transmission with each of the known samples. When the results are plotted as a function of concentration and a smooth curve is drawn through the points, a calibration curve like that shown in Figure 3 for the determination of manganese as permanganate is obtained.

The fundamental theoretical relation for light absorption as a function of concentration is given by the Bouger-Beer Law,

$$\log I_o/I = a\,b\,c$$

in which I_o is the initial intensity of the light beam striking the solution, I is the intensity of the light beam after it has passed through the solution, b is the cell depth or the length of the light path through the solution, c is the concentration of the light-absorbing substance and a is a proportionality constant, called the *absorbancy index*, characteristic of the substance and the wavelength of the light. The ratio, I/I_o, is the fraction of the light transmitted by the solution—the quantity actually measured by the galvanometer reading with most photometers. If this is designated by T the previous equation may be written in the form

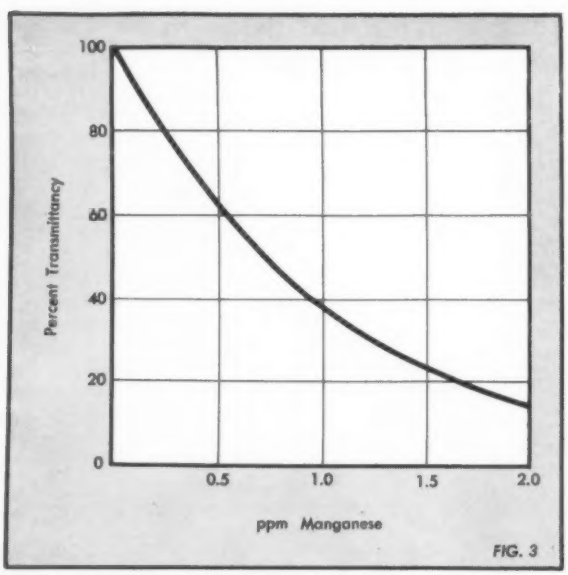
$$\log 1/T = -\log T = a\,b\,c$$

This equation indicates that if the logarithms of the fraction of light transmitted, rather than values of T itself, are plotted against the concentration c a straight line should be obtained. Such a plot is shown in Figure 4 for the same data that were given in Figure 3. Obviously a calibration curve is more readily drawn and fewer points are necessary to establish it, if the logarithmic form of representation of the transmission data is used.

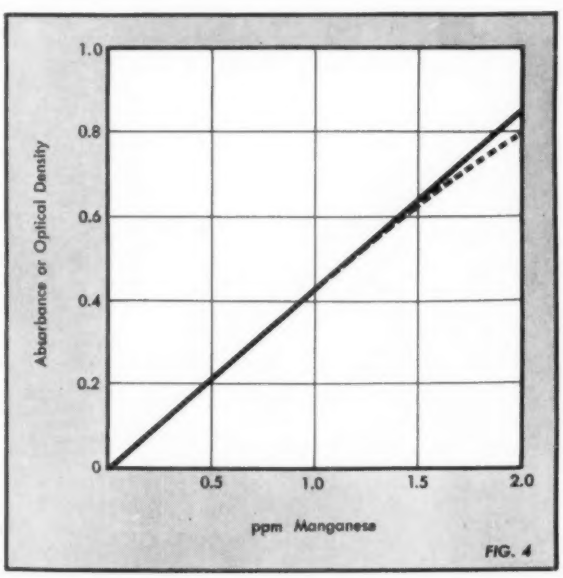
The expression—log T is termed the absorbance, designated by A (in older usage, now not recommended, it was called optical density, D). There is thus a direct proportionality between absorbance and concentration, according to the equation $A=abc$. Many newer photometric instruments have their galvanometer or resistance scales calibrated directly in absorbance units, so that there is a direct ratio between the reading and the concentration.

As can be seen from the equations the relation between light absorption and concentration holds only if the cell-depth or length of light path b is kept constant. Because of this, it is important in photometric analysis either that the same cell be used both for determining the calibration curve and for measuring the light absorption by the sample or that cells with exactly the same depth—optically matched cells—be employed. The equation also shows that increasing the cell depth has the same effect on light absorption as increasing the concentration. Photometric methods thus become more sensitive, i.e. able to determine smaller concentrations of substances the longer the light path is. This has great bearing on the choice of a photometric instrument for water and waste analysis, which often requires the determination of extremely small concentrations of substances. Selection of an instrument that will accommodate cells with a long light path provide a high sensitivity for such determinations and thus gives the greatest range of usefulness in a water laboratory. Allowable cell depths of 4 to 5 centimeters are also essential: even longer light paths are sometimes desirable.

The theoretical equations hold strictly only for the absorption of light of a single wave length. When a band of wave lengths is used, as is the case in all practical photometers, variations from the equations like those shown by the dotted line in Figure 4 are likely to be found. The wider the band of wave lengths used the more extensive the deviations tend to be. This is one reason for choosing an instrument that makes use of as narrow band widths as possible. Deviations from the theoretical like those shown in



● **FIG. 3. Light transmission of permanganate solutions as function of concentration. Wave length 525 μ; 5 cm cell.**



● **FIG. 4. Absorbance (—log T) of permanganate solutions as function of concentration. Wave length 525 μ; 5 cm cell.**

Figure 4 do not invalidate photometric analysis; however, more standard solutions must be run to establish the calibration curve reliably, and one must be careful not to extrapolate the calibration curve beyond the most concentrated standard solution studied.

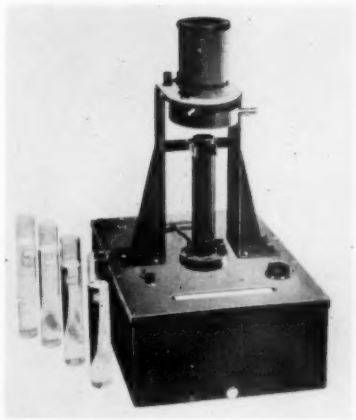
Mathematical studies of the errors involved in photometric measurements indicate that the greatest precision is obtained with standard operating techniques and that best results are obtained when the percentage transmission of light by the sample is in the range from about 80 percent to about 20 percent. Within this range the analytical error is about 3 percent for each 1 percent error in reading the galvanometer or resistance dial.

Photometric Instruments

Because of the ease and versatility of photometric methods of analysis, they have become enormously popular during the past fifteen years. Correspondingly, a large number of types and modifications of instruments have become available from a variety of manufacturers. They range from very simple filter instruments costing a few hundred dollars to complex automatic spectrum scanning and recording instruments costing in excess of ten thousand dollars. For standard water and waste analysis the simpler types costing well under a thousand dollars are amply satisfactory. A few of these simpler instruments are considered here to show something of the variety of types that can be procured.

The least complicated types of instruments are filter photometers with internal arrangements very similar to the schematic of Figure 2a. The light source is almost always a tungsten lamp operated either from a 6-volt storage battery or from a constant-voltage transformer connected to 110 volt AC line voltage. Generally the light receptor is a photocell connected directly to a galvanometer or microammeter. Sometimes they are supplied only with so called broad-band filters, red, green and blue or red, green, yellow and blue, to cover the whole visible spectrum, but most of them are adaptable to narrower band filters which transmit band widths of 30 to 40 millimicrons, ten to twelve being required for the complete spectrum. With proper precautions such instruments may be completely suitable for most routine water and waste analyses.

A particularly interesting example of this type of instrument for water



● **FIG. 5. The Lumetron, Model 450, filter photometer uses 100-ml tubes.**

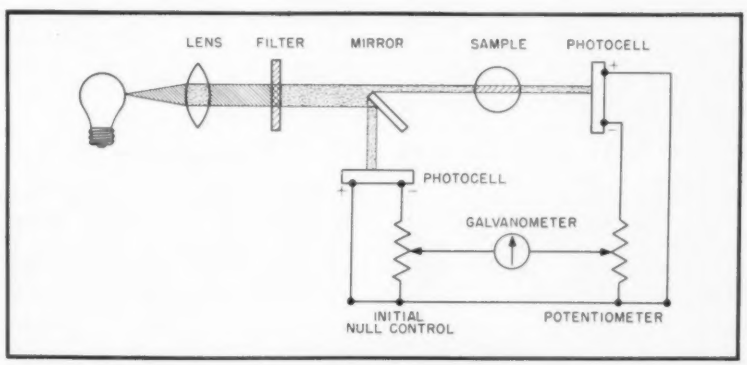
laboratories is the Lumetron, Model 450 (Photovolt Corp., New York) which uses ordinary low-form 100 ml. Nessler tubes as sample holders. A picture of this instrument is shown in Figure 5. The light source here is at the top of the instrument and the light beam passes vertically through the Nessler tube to the photo cell within the housing at the base. Not only is the use of the Nessler tubes an advantage because of their ready availability, but also because they provide a long light path through the liquid and corresponding sensitivity in analysis.

One of the serious problems connected with the use of instruments of the type just described is that of maintaining a constant intensity in the light source. The light intensity at any visible wave length from a tungsten lamp varies with about the 4th power of the applied voltage. Fluctuations in light intensity may be serious and introduce considerable error into analyses even when constant voltage transformers are used, unless the line voltage is quite steady.

In order to circumvent this problem a number of manufacturers have designed "two-cell" instruments that employ two photo-receptors, that operate against one another in the electrical indicating circuit. The theory behind such arrangements is that light fluctuations will affect the two cells equally and thus be cancelled out and also that variations in photocell activity because of temperature changes or "fatigue" would be compensated.

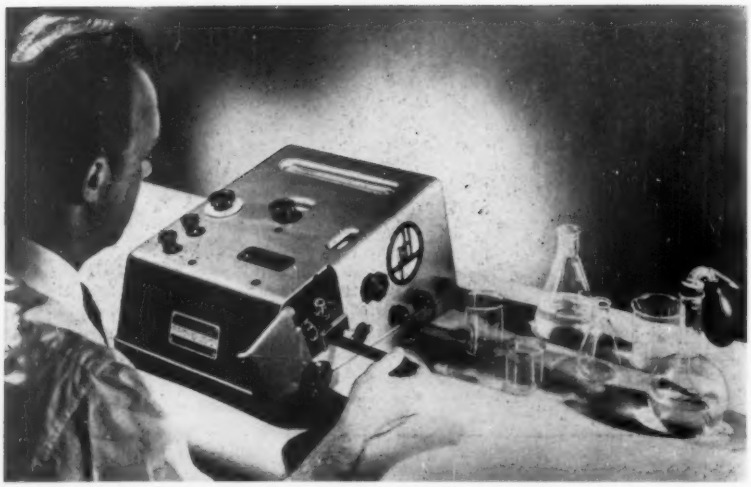
A schematic diagram of a typical one of these two-cell instruments, the Fisher Electrophotometer (Fisher Scientific Company, Pittsburgh, Pa.) is shown in Figure 6. As in all of them, the light beam is split and one portion passes to a "balancing" photo-cell, while the other passes through the sample to the "measuring" photocell. The galvanometer is used as a null meter in these circuits, a variable resistance being used to obtain the balance point. Initially with the blank cell in the sample space and with the resistance dial set at 100 the light reaching the balancing photocell is adjusted until the galvanometer is zeroed. Then the blank is replaced by the sample and the variable resistance is adjusted until the galvanometer again reads zero.

Other examples of this type of



● **FIG. 6. Schematic diagram of the Fisher Electrophotometer, a two-cell instrument that uses a balancing photocell to compensate for line voltage fluctuations.**

construction are the Ammco Type F Photometer (American Instrument Co., Silver Spring, Md.); the Klett-Summerson Photoelectric Colorimeter (Klett Mfg. Co., New York); the Lumetron Photoelectric Colorimeter, Model 402E, and the Fisher Nefluorophotometer. All of these are filter instruments and will take cells up to 4 or 5 cm in the light path (the Lumetron model will accommodate 15-cm cells).



● **FIG. 7. The Coleman Model 14 Universal Spectrophotometer uses a diffraction grating to provide light of 35 millimicron band width for photometric analysis.**

There are a few true spectro photometers that fall within the scope of this discussion. The Bausch and Lomb Spectronic 20 Colorimeter is a very reasonably priced grating instrument with a design very similar to that shown in Figure 2b. The wave length band isolated is about 20 millimicrons centered on any chosen wave length. Unfortunately as presently marketed the length of light path is limited to less than 2 centimeters. The Coleman Instrument Company (Maywood, Ill.) produces two grating instruments, the Junior Spectrophotometer, Model 6A, which is limited to smaller cell sizes and the Universal Spectrophotometer, Model 14, a well-engineered instrument that provides 35 millimicron wave length bands throughout the spectrum and will accommodate cells up to 5 cm in length. The latter instrument is shown in Figure 7. All of these grating instruments employ a single photo-cell as light receptor and must have a stable voltage supply for the light source to give reliable results.

The Beckman Model B Spectro photometer shown in Figure 8 is a prism-type instrument that operates on the principles shown in Figure 2c. Because it employs a photo tube as light receptor together with electronic amplification, it can function on relatively low light intensity and so the wave-length band utilized is very narrow, only a few millimicrons.

Prisms give variable dispersion or spreading of the spectrum with changing wave length and so the wave band is not the same width in various portions of the spectrum. It functions with a single photo tube and so requires a well-controlled voltage supply for the light source. Cells 5 cm in length are accommodated.

Precautions

Modern photometers, like those discussed, are, in general, sturdy, reliable instruments that can be used successfully by technical operators with ordinary skill. They provide greater convenience, accuracy and speed for water and waste analyses as compared with the older color comparison methods.

However, no instrument can correct for slipshod work or improper usage and photometric intruments are no exception to this rule. An important example is that the light receptor of the photometer measures any cause of a decrease in light intensity, not only that due to the color of the sample. If the glass of the cell is dirty so that it does not let all the light through, or if the solution is cloudy the photo-cell will record these effects as decreased transmission and gives no indication that it is a false reading. With visual comparison these outside factors are observed not to be the intended color.

It is also important to remember that instruments such as photometers require regular attention to maintenance procedures if reliable results are to be obtained. Batteries do run down, electrical contacts become dirty, lamps and tubes can wear out. A desirable procedure is to run a known solution in the photometer occasionally to see whether the results obtained check with those for the original calibration curve.

● **FIG. 8. Beckman Model B Spectrophotometer produces spectrum with a prism.**

References For Additional Reading

More comprehensive consideration of photometric methods of analysis and their applications can be found in a number of recent books and articles. Some of these are:

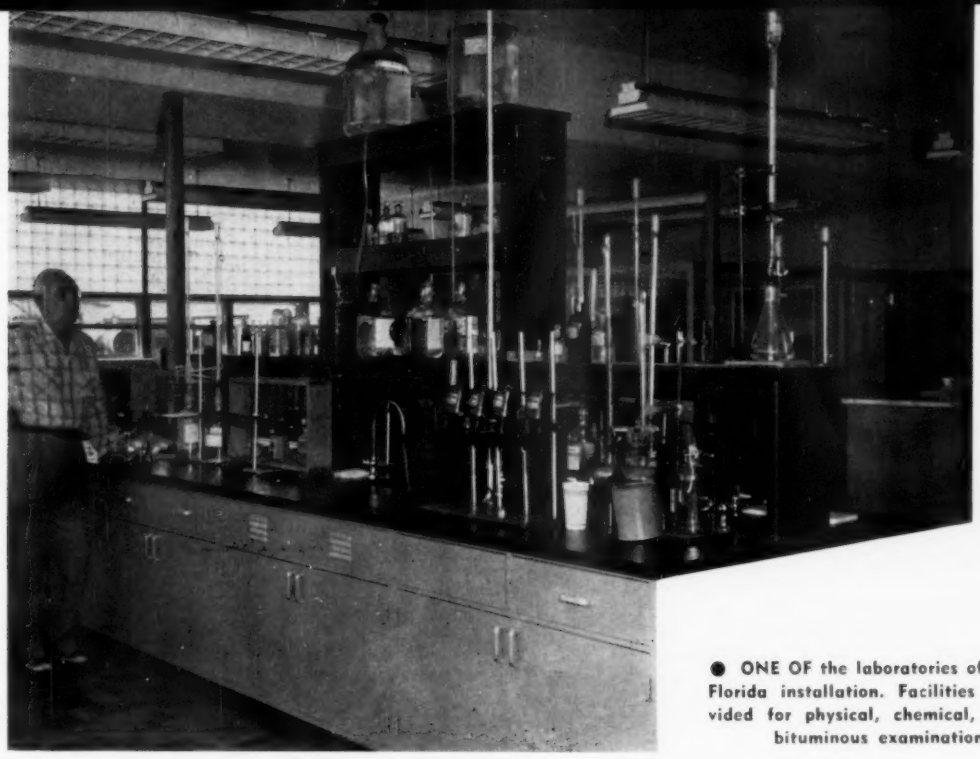
"Analytical Absorption Spectroscopy", M. G. Mellon, John Wiley and Sons (1950). This is a complete and modern coverage of the field.

"Instrumental Analysis", J. H. Harley and S. E. Wiberly, John Wiley and Sons (1954). Chapters 2 and 3 contain a treatment of light absorption photometry.

"Instrumental Methods of Chemical Analysis", Galen W. Ewing, McGraw-Hill Book Co. (1954). Chapter 7 is concerned with analysis by means of light absorption measurements.

"Colorimetric Determination of Traces of Metals", E. B. Sandell, 2nd edition. Interscience Publishers, Inc. (1950). This book contains a thorough treatment of chemistry preceding actual photometric measurements.

"Colorimetric Methods of Analysis", F. G. Snell and C. T. Snell, 3rd edition, 4 volumes. D. Van Nostrand Co. (1948), Vol. I to 1954, Vol. IV. A complete treatise on colorimetric methods.



● ONE OF the laboratories of the new Florida installation. Facilities are provided for physical, chemical, soil and bituminous examinations.

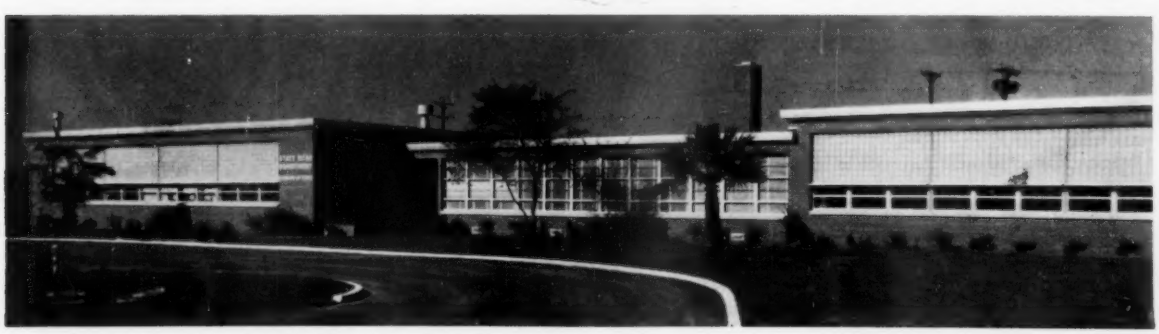
MODERN TESTING LABORATORY FOR A STATE HIGHWAY DEPARTMENT

C. E. WRIGHT

A NEW $250,000 laboratory has been constructed recently by the Florida State Road Department at Gainesville for its Division of Tests. Over the years the laboratory has become an increasingly important factor in the sampling, testing and control of materials in Florida's increasingly large highway and bridge construction program. The new building, with 21,000 sq. ft. of floor space for laboratories and offices will accommodate a staff of about forty, including office workers.

The Division of Tests is headed by a department veteran, H. C. Weathers, who has the title of Engineer of Materials and Tests. His assistant is H. F. McDonell. The staff at the new laboratory is supplemented by four branch laboratories and also by engineers and technicians in five laboratories throughout the state, one in each construction district. These district laboratories make preliminary tests and surveys and send samples and reports to the Gainesville office for further study and analysis.

At Gainesville there are physical, chemical, soil and bituminous laboratories in which all materials used for construction and maintenance are tested to see that they comply with the department's standard specifications and special provisions. In addition to the testing of materials to be immediately used on jobs, the Division of Tests also engages in long-range surveys to determine the relative values of various materials. Some of the current investigations



● ATTRACTIVE and modern building houses the laboratories of the State Road Department, Division of Tests, Gainesville.

relate to corrosion, protective paints, traffic paints and filler materials.

As an example of the amount of work involved in the Florida tests, these are some (but not all) of the materials that are constantly being tested: Cement; mixing water for concrete; fine aggregate or sand for concrete; reinforcing steel; joint filler; paints; creosote oil; guard rail; bituminous material, including asphalts, asphaltic cements and tars; asphaltic mixtures of all kinds; concrete for compressive and flexural strength at various ages; mineral aggregates of crushed stone or slag, shell, sand and mineral filler; surface treatment cover materials; limerock for base and stabilization; soils before and after stabilization; drainage pipe of all kinds; treated structural timber; and timber piling. The division also tests welds and welding procedures and the calibration of asphalt distributors and tanks.

Branch laboratories for limerock analysis are maintained at Ocala, Brooksville and Williston. Inspectors are stationed at stone quarries in the Brooksville area. A laboratory in the Tampa area inspects and tests cement, reinforcing steel, concrete drainage pipe, treated structural timber and piling.

Whenever possible inspection and preliminary testing are done at the source of the material. In a great many cases these sources are in Florida, but when trips outside the state are necessary they are made. For example, before paint was shipped from Baltimore, inspectors were sent there to witness the proportioning and grinding of materials and even the filling of containers. As each container was filled the inspectors put a stamp on it to indi-

Besides designing the asphaltic and concrete mixtures used by the State Road Department, the Division of Tests at Gainesville assists the project engineers and plant and roadway inspectors who are working throughout the state in the standard methods of procuring testing samples and proportioning and controlling mixtures at the plant and on the road. Daily construction reports are submitted to Gainesville by the project engineers to avoid discrepancies.

When a concrete pavement has been completed, a concrete core drill is used by the Division of Tests to determine the thickness of the concrete pavement and final payment is based on these thickness determinations. The finished concrete surface is also checked for smoothness.

One of the results of constant checking of causes of road failures is a stepping up of the weight capacity of sub-grades. Increasingly heavy traffic loads have caused some subsidence of pavements that were built with sub-grades designed for pressure of 45 lbs. per sq. in. Now the usual standard is 75 lbs. per sq. in. To attain this added strength, sub-grades are being made thicker when necessary to counteract unfavorable sub-soil conditions. Florida has almost every type of soil except heavy clay, but is predominantly sandy. Therefore testing to determine the stability of soils is one of the biggest jobs the Division of Tests is called upon to do. A bearing machine which the department designed is one of the most frequently used tools in the laboratory.

Next to soil testing, the most frequent tests are of concrete. For these tests the division for many years has used a Tinius Olsen machine with compression capacity of 300,000 lbs. This can also be used for testing reinforcing bars in tension.

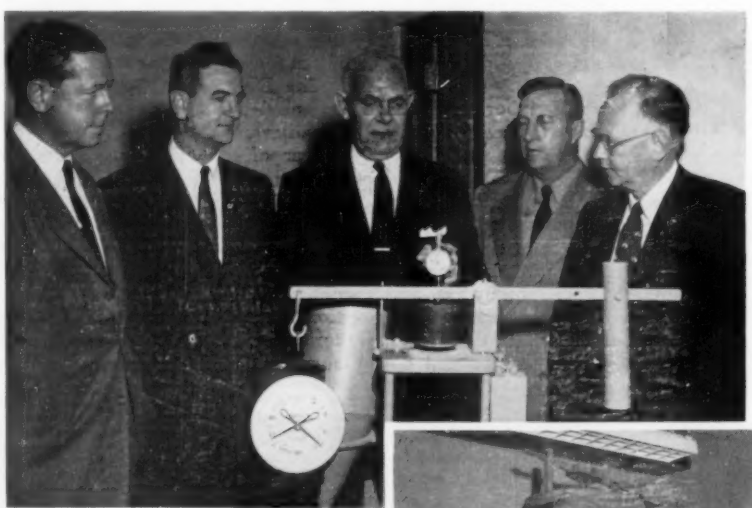
In the new laboratory $28,000 of latest type laboratory furniture, hoods and fixtures were added to an already comprehensive array of laboratory equipment that the Division of Tests had built up over the years.

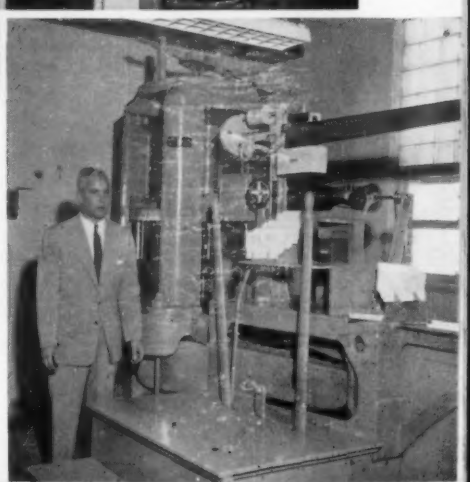
In its recent annual report, the State Road Department commented on the work of its Division of Tests as follows: "1955 marked a milestone in this section's history with transfer to its new laboratory in Gainesville after more than 30 years in an antiquated World War I barracks type building.

"During the year the section conducted in the laboratory 97,235 tests of materials used by the Road Department in construction work and in the field tested other materials which included, for example, such items as 6,155,000 lbs. of reinforcing steel; more than a million and a half feet of structural timber; 314,000 barrels of cement; 446,000 lineal feet of concrete pipe, and more than 37,500 gallons of paint.

"Incalculable savings and better, longer lasting highways have accrued to the taxpayer and motoring public as a result of these exhaustive tests. The laboratory serves as insurance against the use of substandard or inferior materials in all phases of the greatest highway program to date in Florida's history.

"Further, the laboratory personnel over the past year has conducted other and equally exhaustive tests in a constant search for new and better road building materials and toward the development of even more efficient methods and instruments for determining the quality of materials purchased with tax monies."

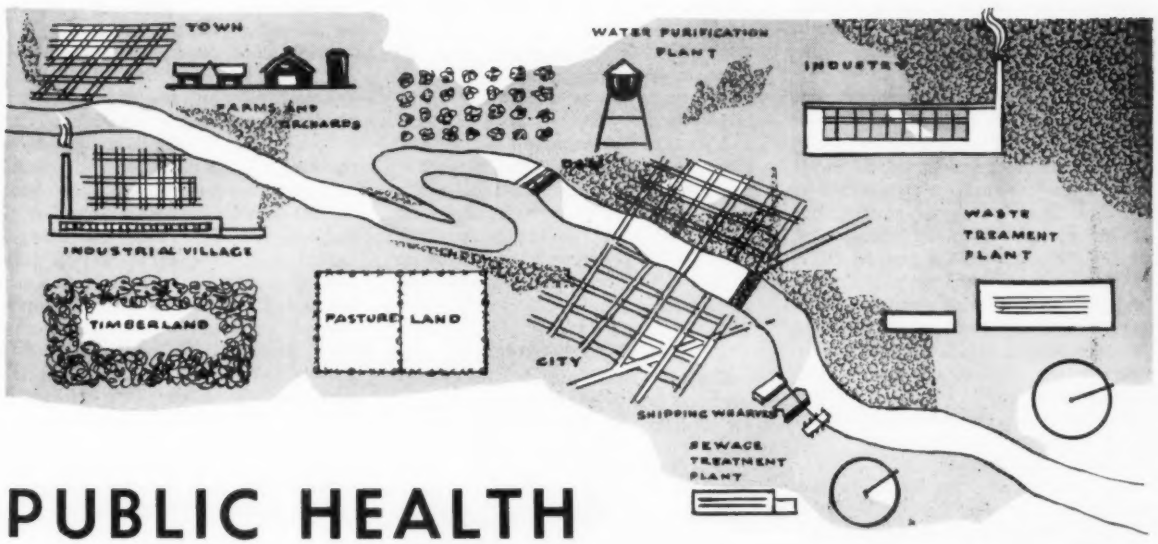




● **ABOVE: At the formal opening, L to R: Wilbur E. Jones, Chairman of the State Road Board; Earl Powers, member of the Board; H. G. Weathers, director of the Division of Tests; H. E. Lewis, State Road Engineer; and Ralph Davis of the Department. RIGHT: Rebuilt Tinius Olsen machine for testing strength of concrete and steel.**

OPPORTUNITIES

In Civil and Public Works Engineering



PUBLIC HEALTH and SANITARY ENGINEERING

BLUCHER A. POOLE, Director, Bureau of Environmental Sanitation, Indiana State Board of Health, Indianapolis, Indiana

A 1951 STUDY by the U. S. Public Health Service indicates that about 30 percent of all the practicing sanitary engineers in the United States were engaged in public health work.[1] Surveys of the Conference of State Sanitary Engineers show that about 700, or approximately one-half of all the sanitary engineers in public health work, are employed by state health departments. While this article deals with the opportunities in a state sanitary engineering department, much of the material contained herein is applicable to the other positions in the public health field.

What The Field Covers

Sanitary engineering activities of a state health department involve water supply, treatment and distribution; the collection and disposal of liquid and solid wastes; the control of insects, rodents and noxious weeds; food and milk sanitation; housing and redevelopment; sanitation of schools, places of public assemblage, camps, resorts, swimming pools and other recreational areas; industrial hygiene; atmospheric pollution; radiation protection; noise abatement and some aspects of accident prevention.

The basic objective of a state sanitary engineering program is to bring into all of these fields physical facilities, programs and practices which will assure adequate protection of the health of the public. Therefore, the first step in any area of activity involves a determination of the problem and a solution to it. Once this is done the project must be sold to the owner who may be the public, a private corporation or an individual.

State sanitary engineers do not prepare plans and specifications or provide direct supervision of construction since these are in the realm of the consulting engineer. They do review and approve plans for sanitary engineering works and many of them make periodic inspections during construction. Upon completion of the works they assist the owner in putting the plant into operation. And they supervise operation of the facility through periodic inspections to assure a product, whether it be water, food, milk, treated sewage or exhaust gases, which is of proper quality. Education of the owner and the operator is an important part of the supervision. It is largely through this medium that expansion, improved maintenance or operation is accomplished.

All state sanitary engineering work does not deal with the installation of structures or the operation of treatment works. For example, water pollution control involves a detailed study of a stream, preparation of reports, and acting as an expert witness in hearings. These may lead to the installation of a treatment works but quite frequently in the case of industrial wastes they bring on housekeeping or process changes. The same is true of industrial hygiene or atmospheric pollution abatement. Insect control may or may not involve physical structures.

Preparation and Training

A bachelor's degree in engineering from an accredited college or university is basic. Completion of a well organized sanitary engineering cur-

riculum, usually given in schools of civil engineering, is advantageous for most jobs although degrees in chemical engineering or mechanical engineering may prove more desirable for certain types of work. The degree should make the individual eligible for admission to examination for a license to practice professional engineering.

Post-graduate study leading to an advanced degree is highly desirable since the sanitary engineer in public health work needs certain specialized knowledge which it is impossible to acquire in a four-year course. Included are the sanitary sciences of bacteriology, chemistry, parasitology, planktology, entomology, and human physiology. The state sanitary engineer eventually must acquire, either through formal education or experience, a knowledge of some of the principles of public health including administration, epidemiology and communicable disease control, and statistical methods.

Many states now require their men to obtain a license to practice professional engineering as soon as they are eligible for licensing. Without such a license the individual has no legal right to call himself an engineer. He will certainly have difficulty in convincing the public he is qualified to conceive engineering projects or in convincing another engineer he is qualified to criticize engineering works if he is unlicensed.

The public character of health work makes certain personal qualities as important as technical and professional qualifications. The individual must be able to establish and maintain favorable human relations with the public, many departments of government and professional groups. These cannot be attained unless the individual possesses integrity, initiative, creative ability, sound judgment, leadership and the ability to get along with people. He must have a sincere interest in benefiting mankind.

How To Get Started in The Field

Many state health departments now have summer work which can be performed admirably by a man who has completed his junior year in an engineering school. This work may consist of water pollution surveys which include the measurement of flow in both closed conduits and open channels; sampling of streams, sewage and industrial wastes; and a certain amount of analytical work. Other examples are control of bathing areas or resort sanitation which will provide experience in small water supplies, small sewage treatment systems, garbage and rubbish disposal. Insect control work can be done by engineering students.

The work described above has the advantage of giving the individual practical experience and giving him an opportunity to find out if he likes health work before he is ready for a permanent job. Similar work is often available on a seasonal basis in the larger water or sewage treatment plants.

A local health department is a good place for the young man to obtain basic experience. Local health work keeps the man right out "on the job" all of the time. With the present shortage of engineers it is not difficult to get a job in a state health department.

How To Progress

There are many possibilities within the state health departments of today for shifting engineering personnel from one type of job to another. The young man should insist on this if his supervisors do not have the foresight to do so on their own initiative. If a young man does a variety of the jobs which occur in any state sanitary engineering department during the first few years of employment he readies himself to take over higher-ranking jobs in a district or regional office or in a large local health department when the opportunity arises. The field is expanding rapidly so the opportunity will arise.

The young man must realize his college work has done little more than teach him the fundamentals of engineering and place him in a position to learn more. If he does his work properly he will learn much from the job alone. In addition he is obligated to budget some of his spare time for professional advancement as well as for recreation.

A young engineer should join at least one professional society and participate in its affairs. He should read a number of the technical publications regularly and he should subscribe to a few even if they are available in his office. He should start his own library.

Most states now have occasional short courses in water supply and sewage treatment and many in other phases of sanitary engineering. The U. S. Public Health Service has a number of excellent short courses each year, most of them at the Robert A Taft Sanitary Engineering Center in Cincinnati. The young man should insist on his employer letting him attend a certain number of short courses. If he is interested in more formal education there are many good night courses available at university extensions in most of the urban centers of the United States. Many state health departments will grant leaves of absence and pay educational stipends for advanced degrees to the men who have demonstrated real interest in the job.

Rewards in Service and Money

While it is generally recognized that salaries in industry are better than in government there is a trend to bring governmental salaries in line with industrial salaries. Thirty-eight state health departments reported salary bracket increases in 1954. Few employers can offer more job security than a state health department.

Entrance salaries for young engineers with a bachelor's degree and no experience range from $4200 to more than $5000 per year. Annual increases probably approach the $230 per year average for all sanitary engineer employees revealed by the 1955 survey of the Sanitary Engineering Division, ASCE, until the

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He is a member of AWWA; FSIWA; APHA; ASCE; and CSSE. He is chairman of the Engineering Comm., Ohio River Valley Water Sanitation Commission; and member of numerous other important official groups.

Half of his military career was spent in the Sanitary Corps where he rose to the grade of Major, serving as sanitary engineer, Office of Surgeon, Hq., 6th Service Command. In 1944 he became Chief of the Water and Sewage Section, R&U, OCE and received the Army Commendation Ribbon for this service. He is a Lt. Col., Engineer Reserve.

average annual salary reaches $6000 to $7500 per year.[2] The majority of the sanitary engineers in state health work with 8-12 years of experience probably fall in this bracket. Obviously some men advance more rapidly if they are ready to take advantage of an opportunity when it arises. Salaries for the 15-20 year experience group will range from $8000 to $9000 per year in a number of states.

Some of the real rewards come from satisfaction in the job. No branch of engineering offers more variety. The work is intermingled between the field and the office and no one is ever "chained" to a desk. In plan review there is an opportunity within a period of a few months to study the plans for many kinds of water, sewage or industrial waste treatment plants. These will have been prepared by many consulting engineering firms. That same time in a consultant's office or with a contractor would be devoted to one or two jobs. The plant operator lives day in and day out with a single plant, while the state sanitary engineer visits a dozen or more in a single month.

Finally in no phase of engineering, or in any other profession, is there greater opportunity to serve mankind. A successful physician confines the activities of a lifetime to the attendance of a few thousand people. The sanitary engineer in a state health department may benefit as many people when he gets one water treatment plant improved or when he completes a single mosquito control program.

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OPPORTUNITIES

In Civil and Public Works Engineering

KARL HOEFLE

Formerly Superintendent,

Water Department,

Dallas, Texas

● **THIS modern water treatment plant at Allentown, Pa., is typical of the many similar plants designed and operated by trained technical personnel for our cities.**

WATER SUPPLY and TREATMENT

MORE AND MORE as our population and economy leap ahead, will water play the dominant role in the distribution of people and in the locations and adequacy of industrial plants needed to support them.

The field of water supply is broad. The choice of supply may involve natural bodies of fresh water, stream flow, impoundment of flood flows, ground water; and perhaps in the near future, conversion of saline waters, a field in which considerable promising research is under way.

Precipitation in one form or another is the source of all surface and underground water. By means of the hydrologic cycle, nature is constantly replenishing the earth's water supplies, but the total water supply involved in the hydrological cycle remains fairly constant. The quantity of water available for man's uses exceeds present day needs. Nevertheless there are many water supply problems. The available supplies are not uniformly distributed over the earth, or for that matter, over our own country. There are large arid and semi-arid areas where water resources are insufficient to meet needs even under the best management. In areas of adequate resources shortages occur due to the erratic nature of the supply. Great volumes pour down in brief periods of time, followed by periods of drought and shortage.

From the very beginning, man has made his settlements where a supply of water existed; where he could supply his needs from lake, stream or spring or lift it from underground. A community's demand for water tends to be uniform, to bear a fairly constant, though growing, relationship to numbers of persons and type of economy. But nature's supply of water is far from uniform. Streams dwindle to trickles or rage in flood. Thus as needs increase it becomes ever more necessary to store portions of the great flood flows that otherwise rush down to the seas, doing no man good and wreaking havoc on the way. Joseph's advice to store grain during the seven fat years for the seven lean years is even more valid now when applied to water.

In only limited areas can communities or industries exist on the minimum yields of natural supplies. Thus the provision of an adequate

and dependable supply nearly always involves storage works. The selection of a storage site involves many considerations. The quality of the water must be such that it is usable, or must be amenable to economical treatment to make it usable. The hydrology of the catchment area must be studied and analyzed to determine how much runoff may be expected. Mass curves of runoff during the driest years of record must be made to determine the probable minimum runoff to be counted upon during a critical period. Consideration must be given to losses by seepage, percolation, transpiration and evaporation to arrive at the probable net yield. Probable cost of the project must be estimated, including the cost of treatment and transportation to the point of use. Then the project must be weighed against the others under consideration before a selection can be made.

The cost must come within the financial capacity of the user. The dependable yield must be sufficient to supply present day needs, and for foreseeable future needs for a period of time, usually specified by the user. There is no exact answer. The best solution may be obtained only through the application of technical ability, training, experience and good judgment.

Preparation and Training

The need for competent engineers in this field is growing rapidly with our expanding population and economy. As the more readily accessible supplies are developed, it becomes necessary to go farther afield to more costly supplies. Projects of increasing complexity and cost require more engineering time and talent than formerly required. It is probably the most promising field today for the young civil engineer.

Formal education of a student intending to enter the field of water supply should include completion of a course in Civil Engineering in which emphasis is placed on hydraulics, hydrology and the design of hydraulic structures. Secondary majors should include geology and meteorology and chemistry of water. It is assumed, as in the case of any student of engineering, that he acquires a thorough grounding in mathematics.

His early training should include two or three years in the field of hydrology, involving compilations of meteorological records and their interpretation; computations of yield and total flows. Field work should include stream flow measurements and investigations and surveys of dam and reservoir sites. This should be followed by work in design of hydraulic structures and in preparation of specifications and writing reports. Variety of experience is a requisite. Therefore the ambitious young engineer should avoid remaining identified with one phase of his training longer than necessary to achieve proficiency. If he fails to make the moves necessary to insure a broad base, he may find himself stuck in a rut. He will have become a technician or a specialist, a good one perhaps, but unable to advance above the limited ceiling of his specialty.

Personal Qualities

What personal qualities are desirable? In the first place, while not absolutely necessary, it is highly desirable that he be sound in wind and limb. The classic conception of the engineer as a roughly clad, booted figure, out in the wilds far ahead of civilization, is no longer valid. Nevertheless, in his earlier years he will encounter a goodly share of rough going when a sound physique will stand him in good stead.

He should be able to get along with people in all walks of life, and especially with those in his own working group. His work will be that of a member of a team. It may be as important, but perhaps no more important than that of other members. The culmination of any engineering work results from the bringing together and coordinating all the concepts and designs of the component parts, some perhaps small but themselves keystones, furnishing necessary support to the whole. He should be endowed with patience. He should have an inquisitive mind, because he must inform himself by seeking out all information and data essential to the task in hand. He must have an analytical mind because he will have to organize and evaluate masses of data so that deductions be not influenced by distortion or misleading indications. It is important that he cultivate the ability to be at ease in any company. He should acquire the ability to speak clearly and convincingly before management groups and civic bodies.

How to Get Started

There are a number of avenues of approach. The Corps of Engineers, U. S. Army; the Bureau of Reclamation; and the U. S. Geological Survey all offer splendid opportunities for young engineers to acquire valuable basic training and experience. Some of the large power companies in the hydro-electric field have good engineering staffs where similar opportunities may be found. In the field of private engineering there is a growing number of large firms with extensive practice in the realm of water supply.

How To Progress

Progress means to move ahead, to advance to an objective, to rise in knowledge and competence. What must not be forgotten is that to build high one must have a broad base. This means the early years must be devoted to broadening the base. And each step upwards calls for farther widening of the base. The young engineer therefore should first move laterally, so to speak, before he moves upward. He should make certain that he becomes proficient in all of the underlying fundamentals of his field, not hesitating to change employment, if necessary, to do so.

It is trite, but true, to say that one's education is never complete. This is especially true in all the fields of applied science. Research and experience are constantly bringing forth new concepts, new materials and new processes. The engineer must keep up with those

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Karl F. Hoefle served the Dallas, Texas, Water Department for thirty-years, the last ten years as its superintendent. During this time he was in charge also of the Dallas Sewerage System and Treatment Plant. To meet the rapidly expanding needs of the growing city, a tremendous construction program was necessary—the building of 395,000 acre-feet of storage; creating a fine new water treatment plant capable of filtering 130 million gallons a day, extending water and sewer mains that cost $82,800,000; and building a giant sewage treatment plant to treat Dallas sewage. Since last August he has been a Special Consultant to Forrest & Cotton, Consulting Engineers of Dallas.

He was graduated from Texas A & M College with the degree of BS in Civil Engineering. He spent more than ten years in Korea on various types of engineering work, gaining that broad base of experience which enabled him later to employ the needed engineering skills to the solution of the water supply and waste disposal problem of Dallas.

developments. He must constantly study and learn or he stagnates. Special courses of study in advanced subjects are made available by many Colleges and Universities through the medium of extension courses or night classes. They offer excellent opportunities for engineers to keep abreast of new developments, or to extend their knowledge in special fields.

Above all he should recognize and measure up to the position of public responsibility and trust which he occupies in his community. But for his work, modern civilization with its great industrial complexes simply could not exist. The lives of countless people are his trust. Mere technical proficiency will not fully discharge that obligation. He owes to them the highest moral considerations in the conduct of his professional work. To fulfill completely his calling he must take an active part in the civic life of his community.

If the desire for great monetary reward is the determining factor in one's choice of vocation, he should pass up the field of water supply, and in fact any field of engineering. In the first place, one imbued simply with the desire for wealth does not possess the fundamental qualification for this calling, essentially one of service to humanity. Secondly, relatively few engineers are listed among those enjoying fabulous incomes. But thousands do realize comfortable incomes from their engineering practice. And their income trend, relative to that of other professions, is rising. It will continue to rise as pressure of population and industrial expansion makes increasing demand for the development of greater water supplies. The intangible or spiritual rewards of the engineer in the field are considerable. The three so-called learned professions: Theology, Law, and Medicine, minister to the needs of mankind through the laws of God, laws of man and the experimental laws of medicine. The water engineer, no less than the physician, ministers to the very life of humanity. To do so he must fathom and obey the elemental laws of nature, which are fixed and definite, but not understood by all who read. He may justly take pride in the great contribution he and his profession have made and are making to good living, to the virtual extinction of water borne diseases and to the lengthening life span of man.

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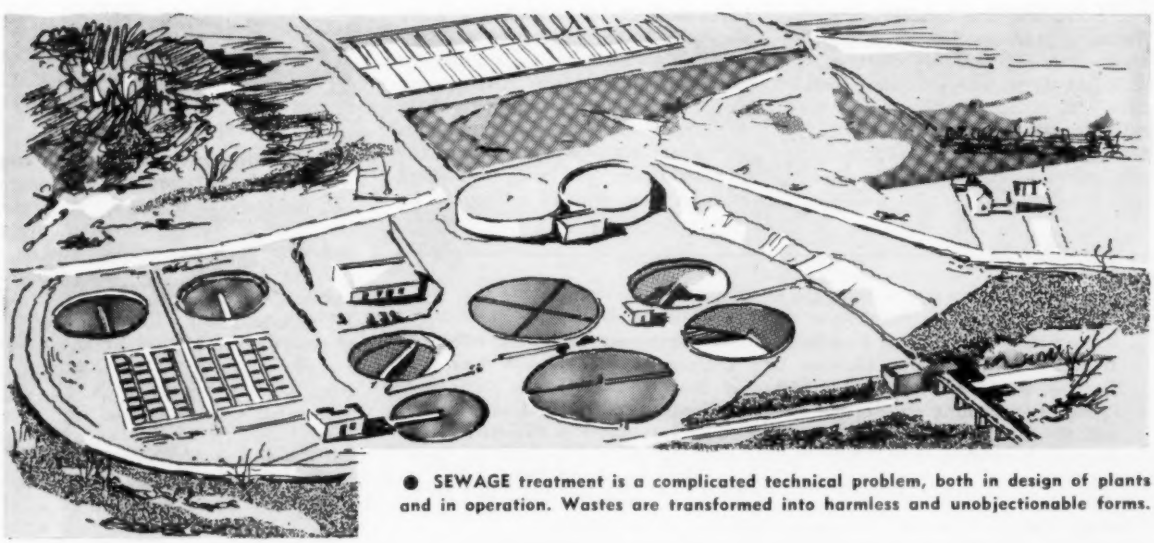

● **SEWAGE treatment is a complicated technical problem, both in design of plants and in operation. Wastes are transformed into harmless and unobjectionable forms.**

SEWERAGE and SEWAGE TREATMENT

ARTHUR H. NILES, Commissioner, Division of Sewage Disposal, Toledo, O.

THE STATEMENT has been truly made that more sewage and industrial waste treatment plant capacity has been constructed and placed in operation in the last twenty-five years than were built in all the preceding time in history. This makes sanitary engineering somewhat of a paradox—that of being not only one of the oldest but also one of the most recent as far as modern concepts go.

Sewerage is defined as a system of sewers (including such appurtenances to the sewers as storm water regulators, inverted syphons, back water or tide gates); pumping stations, and treatment plants. A sewerage engineer must be able to design efficiently any or all of the foregoing. Rainfall data and hydraulics must be intelligently

used in designing storm water or combined sewers. Working knowledge of chemistry, bacteriology and manufacturing processes is necessary to design and operate sewage and industrial wastes treatment plants.

Preparation For Engineering

Assuming that a person has planned to follow the above line of work, what must he do to prepare himself? In high school an engineering preparatory course should be followed. This includes mathematics—algebra, plane and solid geometry and trigonometry—and the sciences, biology, physics and chemistry. In college, a broad civil engineering course should be followed with a sanitary major coming in the 4th or 5th year depending on the school selected. This broad base should be supplemented with report writing, specification writing and a short course in contract law as electives. The ability to write and speak clearly, lucidly and forcefully on engineering matters should be cultivated as a *must*.

Personal Qualities

No one who has trouble with, or dislikes, mathematics or the sciences should consider engineering as a life work. The following qualities and skills moreover are assets: Imagination, curiosity, logical thought, tenacity, industriousness, and manual dexterity, as in drawing; integrity is a necessity.

One anticipating entering the sanitary engineering field should not be squeamish about disagreeable sights or odors. This should not be interpreted to mean that one must enjoy disagreeable surrounding, but he must not hesitate to get dirty if he has to in order to get the information needed. Practically everyone who has followed the construction or operation of sewage collection, pumping or treatment for any considerable length of time, has fallen in at least once and been more or less immersed in his work. It isn't the getting dirty that's disgraceful but in not getting cleaned up afterward.

How To Get Started

One of the best ways to get started in any field is to get a job in that field and start working and studying. Study and keeping up with the latest developments after graduation are a must. If one thinks he has learned all he can or needs to from his classroom work in college he is badly mistaken. All he has to do is look at the accepted designs and methods of 25 years ago and compare them with today's standards. Progress is always the most important product.

The place to look for a job (right now they look you up before graduation) is with a firm of consulting engineers or a contracting firm engaged in designing or constructing water, sewage or sewage treatment facilities. Federal, state, county or municipal sanitary engineering departments, divisions or bureaus are also a potential source of employment. Manufacturers of equipment used in this field are limited employers of sanitary engineers both as designers and as sales engineers.

Private employment as distinguished from public employment usually has the advantage of a higher pay scale but with the possibility of some layoffs, if expected work does not develop, or if adverse economic conditions prevail so that personnel must be curtailed. Public employment on the other hand, especially if under civil service, has greater job security but advancement may not be so rapid.

One of the things a young engineer should look for is opportunity for advancement as he proves himself. However, he may find that the phase of the work in which he is engaged, or the potential in any particular employment, is too limited for his broad development. A young sanitary engineer should not be afraid of changing employment, but should avoid making a record of short engagements without extenuating circumstances. When seeking new employment, the employer always wants to know what the previous work experience has been and why the changes were made.

One of the best ways a young engineer can broaden himself outside of his own employment is to join, while in college, a student chapter of an engineering society and to progress in that membership after graduation. He should meet with other engineers even if they are apparently employed in fields far removed from his own. He should take an active part, attend meetings, take responsibilities for committee work and act as an officer in the organization. He should participate in such activities as are sponsored during "National Engineers Week", the week during which Feb 22 falls, honoring George Washington, the Engineer.

Be A Registered Engineer

Every state in the Union now has required registration for engineers and the prestige that goes with registration is being accepted more and more fully not only by the employers but also by the general public.

On graduating, the engineer is given an examination by the State Board of Engineering Examiners covering the theory which the candidate has been studying. The successful passing of this examination entitles the person to use the title, Engineer - in - Training — abbreviated to E.I.T. In most states, after 3 years of practical work he is again given an opportunity by further examination to demonstrate his development by taking an examination based largely upon the type of practical engineering work which he has been doing since his examination in the theory. The successful passing of this one entitles him to use the title "Registered Professional Engineer" after his name and stamps him as an Engineer of a recognized standard of competence. The registration of engineers is of relatively recent times, but it already has advanced the standing of the profession so that it now ranks

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Arthur H. Niles is Commissioner of Sewage Treatment for the City of Toledo, Ohio. A civil engineering graduate of the University of Michigan, he served in World War I as lieutenant of Engineers. Following release from the Army, he was Assistant City Engineer of Jackson and then of Lansing, Michigan, and City Engineer of Sturgis, Michigan. In 1928 he formed a consulting engineering firm and engaged in the field of Water and Sewage. His work with Toledo proved of such value to the city, that in 1936, he became a full-time employee of the city. Since then he has supervised operation of the city sewage treatment plants and has participated in the design of the large modern plants needed to meet Toledo's needs. Improvements now in progress will cost about $8,500,000.

He has been active in the Federation of Sewage and Industrial Wastes Associations, serving as its president; and in the Ohio Society of Professional Engineers. He is a registered professional engineer.

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with the older professions of medicine, dentistry, law, education and the ministry.

The sanitary engineer may be excused if he feels that he is more important to the community health than the family doctor. The engineer can dispense health to the public on a wholesale basis while the physician is doing it on a retail basis.

However there is a relatively new field called "Public Health Engineering" that does not seem overcrowded. As the name implies it is a profession that combines sanitary engineering with public health. The Public Health Engineer must have a fundamental grounding in sanitary engineering and have knowledge of such things as malaria, rodent, pest and mosquito control and how mass inoculations or immunizations are carried out by the medical profession. So far, this course is offered in only a limited number of engineering schools as graduate work, but it may be just the specialized line of sanitary engineering that would appeal to one who has a great interest in public health work and the service it renders to the people of the world.

Rewards in the Profession

There are at least three different rewards in any line of work. There is the monetary reward, the reward in service to the public as a whole, and the personal feeling of reward from doing a job to the best of one's ability.

The sanitary engineer, will in all probability, not receive the pecuniary reward of some of his brother engineers employed by industry or the more successful consulting engineers. Sanitary engineering is a specialized field and a sewerage engineer is an even more specialized one. The more specialized a field becomes, the harder it is to escape from it into the broader fields of industry or public management; hence the engineer has to be content to advance as much as possible within its confines. By joining and taking an active responsibility in the local, state and national organizations with which his work is associated, he may seek to serve ever broader fields. This brings a feeling of pride and satisfaction to him and to his community as he advances to offices of more and more eminence. While it sometimes brings monetary recognition, it cannot help but enhance his personal satisfaction of service in wider and more responsible fields of engineering; and it brings also broader views and rewarding contacts.

OPPORTUNITIES

In Civil and Public Works Engineering

BEN PETTY

Professor of Highway Engineering

Purdue University

Lafayette, Indiana

● **TYPICAL of modern engineering school buildings is the Memorial Union at Purdue.**

TEACHING: THE PROFESSOR of CIVIL ENGINEERING

TO THOSE of us who are not afflicted with an overpowering desire to become rich, the profession of teaching provides a good life and a wonderful medium for self expression. The pleasure and spiritual rewards that come from close association with, and from wisely influencing, young students, are truly compensating.

No job is perfect, but it seems to me that, in general, teachers garner an abundant share of the good things of life which, in many ways, compensate for a salary scale that is considerably lower than pay rates for equal capabilities in business, industry, and in other professions.

Living conditions in a college or university community are, as a rule, highly desirable. Many inspirational, educational, and entertaining features such as lectures, dramatics, musical events, athletic contests, library facilities, adult education programs, etc., are "at your service" at little or no cost.

A teacher of engineering is, within limits, pretty much his own boss. Of course directives, assignments, and overall supervision emanate from his superiors. And university codes aim at keeping one's activities and personal conduct within reasonable bounds. Nevertheless, such teachers enjoy much freedom in development

of course content, methods of presenting subject matter in class and laboratory, and in other teacher-student contacts.

The general atmosphere of a college or university campus is one of learning and of culture. One is thereby stimulated to a life of continuing study, particularly in his chosen field. This not only extends one's own knowledge but also develops better qualifications for advancement in the teaching profession.

Opportunities, facilities, and encouragement to carry on research in the chosen specialized field are available for teachers so inclined. This varies from applied research to pure research which, in many cases, bring renown and monetary rewards for outstanding accomplishments.

The younger teachers have opportunities to carry on graduate work in addition to their teaching assignments, resulting in advanced degrees which are so highly rated in some quarters.

Another avenue of self expression is presented to those talented in the orderly marshalling of words, by way of writing for technical magazines, authoring bulletins, and editing and publishing textbooks. These not only satisfy the teacher's urge, but also enable others to benefit from his learning and make him better known in his field, with resulting opportunities for occupational advancement.

As one advances in his professional field, avenues of public speaking open for him. If he possesses, or can readily develop, talent to become a *good* speaker, he will be called upon for addresses before many and varied types of groups and associations in his field. This, too, contributes to his prestige and furthers his chances for advancement. It also *can* result in substantial monetary rewards if he is *really good.*

In the teaching field, opportunities may arise for one to organize and supervise conferences, short courses, extension work, etc. These develop leadership and managerial abilities and provide numerous contacts and friendships with off-campus people that can be very satisfying and beneficial.

Naturally, a teacher of engineering should be a graduate of an engineering school. As things are going now in engineering education, a Master's Degree is required by most institutions; it is either required for a beginning Instructor, or must be acquired as a qualification for promotion to the rank of Assistant Professor. In too many institutions the Doctor's Degree is essential to a staff appointment; or at least must be acquired before a teacher can hope to aspire to the rank of Professor. In this writer's estimation, this state of affairs is extremely unfortunate. The mere possession of a Doctor's Degree is no guarantee that the owner will even come near to making a really good teacher. Practical experience, plus other desirable personal characteristics, may provide far more *real* qualifications. But apparently, little or nothing can be done about it, so anyone aspiring to become a Professor of Engineering, now or in the foreseeable future, should take graduate work, leading to a Doctor's Degree in due time.

Characteristics of a good teacher include a zeal for learning, a desire to impart such learning to his students, and the ability and zest for stimulating students to their fullest capabilities of acquiring knowledge on their own. A sincere interest in students, a pleasing personality, a sense of justice, good character, freedom from unfavorable complexes, and a driving interest in the teaching profession as a career—all are prerequisites.

Monetary rewards will not be startling in their magnitude. In fact a beginner may not make as much as a tractor operator on the nearest road construction job, or as much as the janitor makes in the building where his office is located. But there are many compensating values involved. In a reasonable period of time, any good teacher should advance to a salary rating that will permit him and his family to live decently and in reasonable comfort. After all, it is not necessary, on a college campus, to "keep up with the Joneses". You will experience just as much respect, admiration, and good will from your colleagues if you decide to live and work within your means.

Most colleges and universities allow ample vacation periods, have good retirement plans, provide low-cost health and accident insurance and ample group life insurance for staff members at very low rates. All in all, the teaching profession offers a *good life.*

Prof. Ben H. Petty is probably the best known teacher in the highway engineering field. Not only has he given sound engineering training to thousands of young engineers, but his leadership has created the famed "Purdue Road School" which has been a model for countless others and a center from which research in highway engineering has emanated.

He was graduated from Purdue's Civil Engineering School in 1913 and spent the next seven years on flood control work. In 1920, he started at Purdue as Instructor in Highway Engineering and, except for active duty with the Army in World War II, he has been there ever since.

There is no room to list here the honors that have been bestowed on him, nor the organizations to which he has contributed as a member or an officer, but his participation in the work of the Highway Research Board, the American Road Builders' Association and the Highway Division of the American Society of Civil Engineers has been outstanding.

• • •

OPPORTUNITIES in CIVIL and PUBLIC WORKS ENGINEERING

THERE IS A great need today for more engineers. Civil and Sanitary engineering, in common with other branches of the profession, are faced with a shortage of capable men who, by virtue of technical training and experience, are fitted for responsible positions.

To relieve this shortage in the future it is essential that young men planning their careers are fully acquainted with the advantages and opportunities that exist in the civil and public works engineering field. Accordingly, the Editor of PUBLIC WORKS has asked twelve leaders in various phases of the field to tell of the future that exists for young engineers in these professional areas.

This is the second of the three series of articles that will be published. The first series appeared in the March issue of PUBLIC WORKS and the reprints of this series are now ready. Reprints of each group of four articles will be available. In order to provide colleges with data which they may distribute to high schools, up to twenty copies of each reprint will be furnished without charge to any Professor of Civil Engineering on request. Larger quantities will be supplied at cost.

DESIGN THEORY OF

SEDIMENTATION TANKS

R. W. CHRISTY

Sanitary Engineer

Link-Belt Company

IN CONSIDERING the hydraulic features of a sedimentation basin, it is necessary to revert to the work done by Hazen in 1904. Hazen made three basic assumptions, and from this point he went on to develop his theory. The assumptions he made were as follows:

1. Particles are discrete and do not flocculate.
2. Flow is streamline and the particle path line of settleable solids is straight. There are no eddies or irregularities in the flow caused by turbulence.
3. All particles striking the bottom remain fixed.

Under these conditions, a particle starting to settle from the top of the basin will follow a path indicated by a straight diagonal line, and its velocity has horizontal and vertical components. The vertical component is commonly referred to as the velocity of subsidence. Without following through mathematical procedures, it can be stated that the removal efficiency of a particle in a settling basin is dependent upon the overflow rate. Actually the theory developed by Hazen does not accord completely with conditions existing in actual sedimentation basins. Solid particles encountered in sewage and industrial waste are not discrete and do flocculate. The flow pattern is not streamlined in a settling basin and turbulence and temperature differential will result in eddy currents or irregularities in the flow pattern. Particles that strike the bottom of a settling tank do not remain fixed. High velocities will raise the particles from the floor.

How do these non-ideal conditions affect settling tank efficiency and what can be done to minimize their adverse effects? For purposes of discussion, a settling basin may be subdivided into three sections: The inlet zone, the settling zone and the outlet zone.

The Inlet Zone

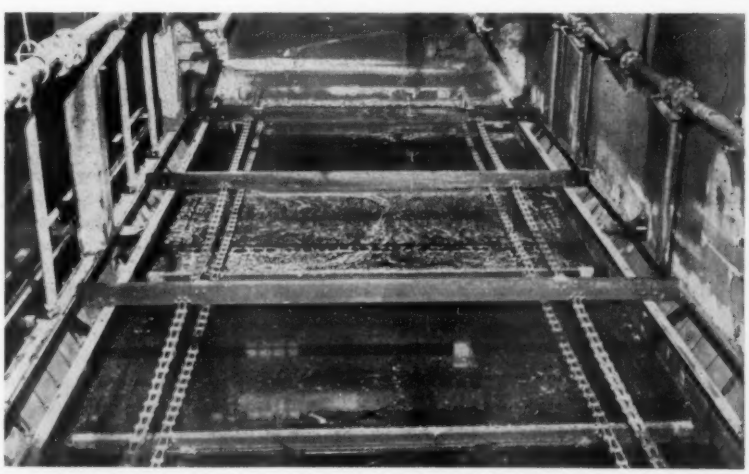
The horizontal distance comprising the inlet portion of a well-designed settling basin, it has been found, should be equal to about the depth of the tank. The inlet of any basin should permit the energy of the entering stream to dissipate itself. A mass of water in itself will act as a means of damping the inlet velocity. Tanks that are excessively shallow at the influent end lose this damping effect. An inlet baffle that tends to deflect the flow downward is an effective means of dissipating inlet velocities. The top of the baffle should be about 2 inches below the liquid surface. This will allow the scum and grease to be carried into the path of the collecting mechanism. The bottom of the baffle should extend at least 12 inches below the bottom of the influent ports.

Good inlet design is important. The wider the tank, the more difficult it becomes to distribute the flow across its full width. The relatively high inlet velocities encountered in long narrow tanks are stabilized well within the distance allowed for the inlet zone by the baffle and the contained liquid. A circular radial flow type of tank requires careful attention to inlet design. In small tanks of this type, the percentage of floor area available for settling is quite small if too great a distance is required to dissipate the inlet velocity. As a result, dye tests have indicated that suspended matter may reach the effluent weir of a small circular basin in 15 percent of the theoretical detention period. In rectangular basins having length to width ratios as great as 5 to 1, the suspended matter may reach the effluent in about 50 percent of the theoretical detention time.

With the tank depth constant, a decrease in the theoretical detention period results in an increase in the overflow rate. Increasing the overflow rate results in an increase in the concentration of suspended particles present in the clarified zone due to the fact that the settling velocity of the particles is not great enough to allow the particle to reach the floor of the tank.

Thus it can be seen that the problem of introducing sewage or industrial waste into a settling basin centers about a reduction in the inlet velocity. If the sedimentation basin is preceded by a flocculation tank of equal width, the problems normally encountered in inlet zone de-

This article is based on a paper by Mr. Christy, at the Fourth Annual Meeting of the Nebraska Sewage and Industrial Waste Association. It has been rewritten specially for PUBLIC WORKS and has been cleared by FSIWA.



● **ARRANGEMENT for preaeration with rectangular settling tank. Air piping is shown with diffuser plates set in sides perpendicular to direction of flow in tank.**

signs are eliminated. This point will be discussed in more detail later.

The Settling Zone

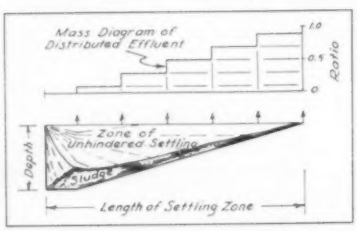
To date, research investigations have offered little or no information that would lead to the improvement of the settling zone. Multi-tray tanks, which increase the floor area, have been used in water treatment settling tanks with success. From theoretical considerations, it is obvious that an increase in the amount of floor area results in an equal increase in the amount of solids removed. However, the use of such tanks in the field of sewage treatment has not met with the same success. Septic sludge and scum rise to the surface and to date equipment has not been developed that can economically clean both top and bottom of the trays.

In 1950, experimental studies were undertaken at Harvard University to develop a sloped tank that would provide higher settling efficiency and lower construction cost through reduced volume. Fig. 1 illustrates the tank resulting from these studies. Any solid that enters the settling zone at a point above the diagonal pathline will pass on into the outlet zone and will not be removed from the waste stream. Referring to Fig. 1, it can be seen that the volume of the tank beyond the pathline contributes nothing to the removal of solids. This area can be used to greater advantage if it is replaced with effluent troughs to remove equal portions of flow as indicated by the arrows along the top of the tank. The mass diagram serves to illustrate this point graphically. Fig. 2 shows the general arrangement of a full scale tank, the Uniflow, constructed on these principles. Actual construction differs from the ideal tank, in that the effluent end must be at least 4 feet deep to allow space for the scraper flight to pass around the sprocket and still clear the effluent trough. This minor deviation has not seriously affected the results obtained.

The slope of the floor is determined by making the water depth at the influent equal to twice the depth at the effluent. For example, if the depth of the water at the effluent is 4 ft., the depth at the influent must be at least 8 ft.

The advantages of this radically sloped tank may then be enumerated as follows: (1) The tank volume is reduced by 25 percent to 33 percent without any reduction in the surface area; (2) The horizontal velocity approaches a uniform rate throughout the length of the tank, reducing short circuiting and eddying currents; (3) The influent end of the tank provides the same mass of water as a conventional tank for the dissipation of inlet velocity.

The same principles may be applied to a circular tank. In fact, greater savings may be possible with circular tanks. In rectangular tanks, the radical slope presents a somewhat more complicated forming problem for the sidewall footings. In the circular tank, this objection is not encountered as the footing for the outside wall is at a constant elevation.



● FIG. 1.—Tank length to depth ratio.

For many years very little attention was paid to the method of removing the effluent from the settling tank. It was common practice to install a single overflow weir preceded by a scum baffle. Now many State Boards of Health require that weir overflow rates shall not exceed 15,000 gallons per day per lineal ft. of weir. It is impossible to have too much weir length; the more weir length installed in a settling tank, the less tendency there will be to induce eddy currents or upflow currents in the outlet zone.

Today, most medium and large size tanks have mechanical scum skimmers. In order for these scum skimmers to function properly, it is necessary to hold the fluctuation of the water level in the settling tank to a minimum. The more weirs installed in the settling tank, the less will be the fluctuation in the water level.

The scum or effluent baffle should be located about 18 ins. from the upstream effluent trough. Experience has shown that most of the scum that can be removed from a domestic sewage, or from the average industrial waste, will rise to the surface of the tank within the first third of the total flow distance. Some designers have avoided multiple effluent troughs because they felt that they would not be providing sufficient area for the removal of scum. Considering that any scum to be removed will rise to the surface in the first one-third of the length, there is no valid reason why a portion of the effluent cannot be taken off from the settling tank at any point beyond the first one-third of the tank length.

Pre-Flocculation

Settling basin design discussed so far has dealt entirely with free settling particles unaided by any flocculating medium. Pre-flocculation, prior to sedimentation, has been neglected. Benefits derived from pre-flocculation can conceivably save considerable cost in the construction of the primary settling tanks; but to date, sufficient data have not been accumulated to permit a State Board of Health to give adequate credit for this process. Although pre-flocculation is encouraged, using it does not allow the designer to reduce the detention time or size of the primary tank below what would normally be required if pre-flocculation were omitted. Pre-flocculation is considered only as an additional process to provide a better degree of treatment than settling alone.

Pre-flocculation may be accomplished with the aid of a coagulant, such as alum or ferric chloride; or it may be obtained by developing a floc through the use of rotating paddles or diffused air. The high chemical cost has, in most cases, eliminated the use of alum or an iron salt. Pre-flocculation can be obtained by mechanical means but the use of diffused air holds the greatest promise as a suitable flocculating medium. Diffuser tubes are relatively economical to maintain and the air has a tendency to float grease and oils.

Many of the pre-aeration tanks built in the United States have been separated from the primary settling tank. The sewage is transferred from the pre-aeration tank to the settling tank by either a narrow influent channel or a pipe. In either case, high velocities can destroy the flocculating benefits achieved in the pre-aeration tank. To avoid this, a pre-flocculation or pre-aeration tank should be an integral part of the primary settling tank. Three reasons are apparent: (1) Floc formation is not destroyed by interconnecting piping or channels; (2) distribution of flow into the primary settling tank or compartment is no longer a problem; and (3) solids which settle in the aeration compartment are removed by sludge collectors, eliminating manual cleaning.

In 1940, Fischer and Hillman reported that 20 minutes of flocculation of raw sewage prior to settling would increase the removal of the suspended solids during 60 minutes of settling by 4 to 35 percent over results that were normally obtained

without any flocculation. These results have been confirmed in recent pre-aeration installations.

At this point, is is well to emphasize that percent removal of the suspended solids can be quite misleading. Experience has demonstrated that suspended solids will be reduced to a concentration of about 45 ppm regardless of the concentration in the raw sewage. Expressed in a numerical example, installations have been encountered where the raw sewage will contain as much as 300 ppm of suspended solids and the effluent will be reduced to 45. This amounts to an 80 percent removal. On the other hand, a weak sewage containing around 100 ppm of suspended solids, will still be reduced to the 45 ppm concentration. This amounts to a reduction of 55 percent. Obviously there is no direct relationship between the concentration of solids in the raw sewage and the concentration in the effluent.

There has been extensive literature published reporting various degrees of success in the removal by preaeration of BOD, odor, sulphides, carbon dioxide and grease. Some hydrogen sulphide and carbon dioxide gas will, of course, be swept out of the raw sewage by the air. The BOD will be reduced, but it is not clearly defined how much results from the oxygen absorbed and how much from the removal of the suspended solids having a BOD demand.

There is much research to be done along these lines, but it can be stated that the use of a pre-aeration tank in conjunction with a primary settling tank has a marked effect upon the reduction of suspended solids.

Pre-Aeration

Pre-aeration systems constructed integrally with the primary settling tanks have introduced some interesting changes in the mechanical equipment required for collecting sludge. Diffuser tubes (or plates or jets), placed perpendicular to the direction of flow give a coalescing effect across the full width of the pre-aeration compartment. However, it has been common practice in pre-aeration tanks to arrange tubes parallel to the sidewalls along one or both sides of the tank, which produces a rolling motion and keeps the heavy solids from settling out of the waste stream. The arrangement necessitates a volume of air sufficient to keep the solids in suspension. This volume of air may be much in excess of that necessary to produce a good floc formation. In fact, this amount of air may possibly have a detrimental effect on the floc and actually hinder settling characteristics. Research work by Thomas R. Camp has emphasized this point and the results may be read in Separate No. 283 of the Proceedings Separate published by the American Society of Civil Engineers.

Operating experience has shown that air bubbles may form a scum at the surface of the water, thereby tending to reduce the concentration of flocculable particles. However, this is not a serious disadvantage as the floc entrapped in the scum can be removed immediately by the skimming action of the flights in tanks constructed with the pre-aeration compartment as an integral part of the primary settling tank.

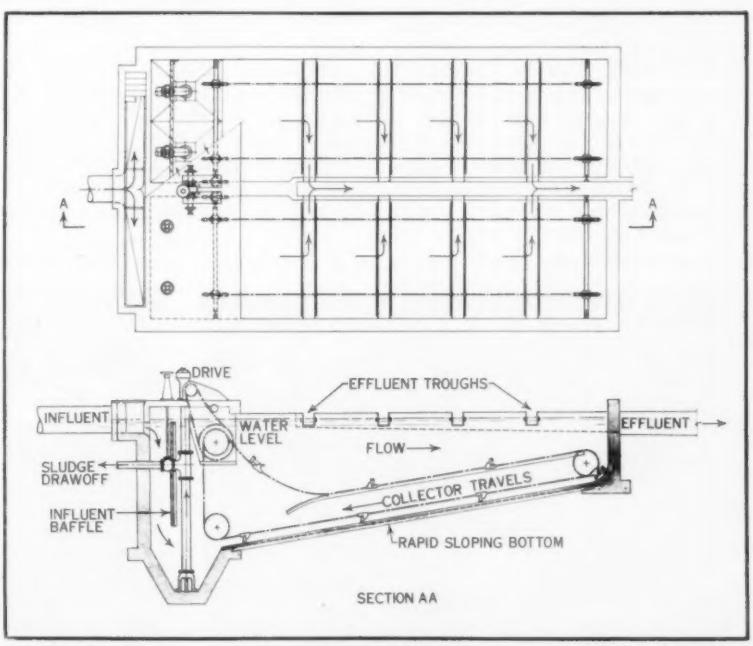
One precaution is necessary when the sludge hopper is located at the effluent end of the tank. A baffle is installed immediately upstream from the sludge hopper. During warm summer days, sludge will occasionally bulk from a hopper and rise to the surface of the tank. If the baffle is omitted, this sludge will have a tendency to flow over into the effluent troughs. The amount of sludge that will bulk and come to the surface of a tank immediately above the sludge hopper has not been found to affect the BOD of the effluent seriously, but it presents a somewhat unsightly appearance and for this reason should be avoided.

A quiescent zone is provided between the aeration and settling zone to permit the dissipation of velocities introduced in the aeration compartment. A 15-minute quiescent period has been found satisfactory in most cases. The upstream baffle separating the quiescent and settling zone should just permit the clearance of the flight collector and at the same time allow about 3 inches of water depth over the top of the baffle to allow the scum and grease to be removed by the skimming mechanism.

Until such time as data become available indicating the proper amount of air required for flocculation designers should provide as much flexibility in the air supply as possible. A suggested arrangement would consist of two blowers having a maximum total output equal to 3 cu. ft. of air per lineal foot of pre-aeration compartment. Provision should be made to allow adjustment of the blower output, as determined through field experience, to provide a floc of maximum settling velocity.

Although sedimentation has been used for years, much remains to be learned. An attempt has been made here to correlate some of the more pertinent data. Some of the fundamental and basic theories of sedimentation have been discussed in detail in order to present a more vivid picture of the settling phenomena.

The possibilities of understanding and improving settling tank performance have by no means been exhausted. The best machine for cleaning settling tanks has not yet been developed by equipment manufacturers. Although sedimentation is an age-old science, the field for equipment and process improvements is unlimited.



● **FIG. 2.—General arrangement of full scale tank illustrates slope of the floor.**

ADVANTAGES OF AERIAL MAPPING FOR SMALL COMMUNITIES

● SHOWN is an aerial photograph of the downtown section of Portland, Oregon.

MUCH HAS been said about the use of photogrammetry for city planning in large metropolitan areas, though relatively little mention has been made of the possible uses of photogrammetry and precision topographic maps in small communities facing the problems of expanding population and economy.

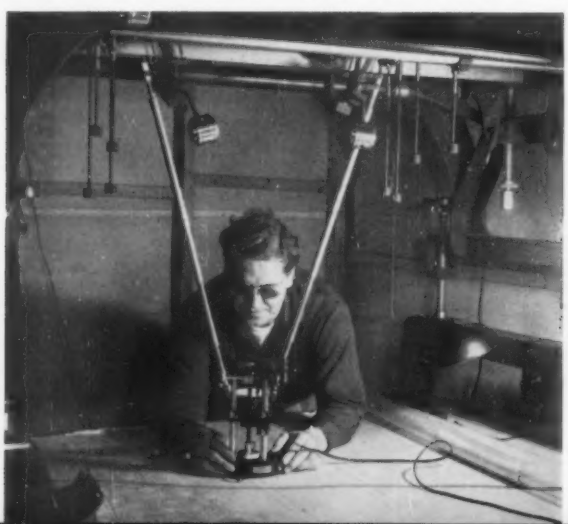
At a cost which may be less than one engineer's salary for a year, a small community can obtain the following information on its developed areas and surrounding environs by photogrammetry: 1) A series of control surveys resulting in monuments for position and elevation based on a common datum; 2) a common coordinate system for the city's future, based on lambert coordinates; and 3) maps drawn at 100-ft. to the inch or 50-ft. to the inch scales, showing all features of planimetry, buildings, sidewalks and structures, with 2-ft. contours.

Furthermore, the use of photogrammetry simplifies the problem of deleting and adding to the map to bring it up to date as time goes along. A few more photographs and a few hours' time on a map machine will fill in areas where revisions on the map are necessary or more details are required.

Recent developments in photogrammetric equipment as well as the cumulative experience gained by photogrammetrists and engineers using photogrammetry in the last ten years has made it possible to increase the accuracy in precision of topographic mapping. These maps are frequently made on glass cloth or extremely stable materials so that the accuracy of plotting is not disturbed by expansion or contraction of the substance on which the map is produced. Frequently all visible features in the photograph, such as manhole covers, fire hydrants, sidewalks and driveways are plotted on these maps. Maps such as these are being used by highway departments in lieu of field surveys for making up final highway design and for purchasing right-of-way. They provide the basic data for future planning and zoning in the city, and provide sufficient engineering data to aid in the design of structures.

This article has been prepared from data furnished by K. B. Wood and Associates, Inc., Portland, Ore.

● KELSH plotter being used in preparation of aerial maps.



● MULTIPLEX stereoprojectors used in extending control.

NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Urban Transportation Group Selects Pilot Study Cities

Detroit, Michigan. The National Committee on Urban Transportation met in the Motor City on March 12th and 13th. The first day's session was devoted to a review of each section of a comprehensive fact-finding manual with the chairmen and secretaries of the nine subcommittees which prepared the impressive document. Seven pilot study cities were selected on the second day of the meeting to test various parts of the manual under actual field conditions. The cities selected were: Detroit, San Diego, Albuquerque, Phoenix, Syracuse, Oak Park-Ill. and Crawfordsville-Indiana. An advisory staff will assist the selected cities and participating transit companies in organizing and guiding the pilot study program. The field studies are to begin within the next 60 days and be completed by July 1, 1957. The manual will then be revised in the light of the experience gained from these studies and thereafter published for general distribution. The National Committee also decided to prepare a companion manual which will deal with the techniques of analyzing, evaluating and utilizing the data that is collected.

This second manual will also include recommended standards for street and transit facilities and services.

This important committee was organized in May, 1954 by several national organizations including the American Public Works Association. William A. Rusch is Staff Director of the committee which maintains its offices at 1346 Connecticut Avenue, N. W., Washington, D. C.

Virginia and D. C. Members Organize New Chapter

Lynchburg, Virginia. J. D. Wright, Director of Public Works of Lynchburg and State Chairman for Virginia recently submitted, to the APWA Board of Directors, signed petitions from 70% of the active members in Virginia and the District of Columbia, calling for the establishment of a new chapter to serve the members in that area. Plans for organizing the new chapter were made in Richmond, Va. on March 9th at a meeting arranged by the State Chairman. Others present were: Sol Ellenson, Director of Public Works, Newport News who is a member of the Associations Board of Directors. William A. Xanten, Superintendent of Sanitation, Washington, D. C., and Past President of the APWA, and R. S. Hopson, Director of Public Works of Richmond. The Board's action on the petition will be announced in the near future.

Eisenhower Names Scientists And Engineers Committee

Washington, D. C.—President Eisenhower, early last month, established a "National Committee for the Development of Scientists and Engineers" to investigate the growing shortage of trained technicians. The President said that because of the increasing importance of world technological leadership, a concerted effort was needed to increase the supply and improve the quality of scientific and engineering personnel. He named Dr. Howard L. Bevis, President of Ohio State University, as chairman of the Committee, and Dr. Eric A. Walker, Dean of Engineering and Architecture at Pennsylvania State University, vice-chairman. Seventeen other leaders in education, science, labor and business will serve on the committee.

Street Lighting Discussed At Philadelphia Meeting

Philadelphia, Pa.—Members and guests of the Philadelphia Metropolitan Chapter enjoyed a very instructive meeting at the City's new Street Lighting Warehouse on Thursday evening, March 22. The new warehouse, which cost $50,000

Harold E. Mason, Street Lighting Engineer of Philadelphia, Pa.

is fully equipped to carry out the vast street lighting modernization program which is now underway in Philadelphia. Street Lighting Engineer Harold E. Mason was the principal speaker at the meeting which also included the presentation of a movie titled, "Out of Darkness," by the General Electric Company.

Training Draftsmen On The Job

Milwaukee, Wisc.—Warren F. Braag, Training Coordinator, for the

OFFICERS: Edward P. Decher, Newark, N. J., *President;* Frederick W. Crane, Buffalo, N. Y., *Vice President, Eastern Area;* Kenneth K. King, Phoenix, Arizona, *Vice President, Western Area;* Walter M. Swietlik, Milwaukee, Wisconsin, *Vice President, Central Area;* Albert G. Wyler, New Orleans, La., *Vice President, Southern Area.* DIRECTORS: W. D. Hurst, Winnipeg, Manitoba, Canada; Sol Ellenson, Newport News, Virginia; Roy W. McLeese, Salt Lake City, Utah; Jean L. Vincenz, San Diego, Cal. Warren A. Coolidge, Nashville, Tenn., *Immediate Past President;* Donald F. Herrick, *Executive Director.*

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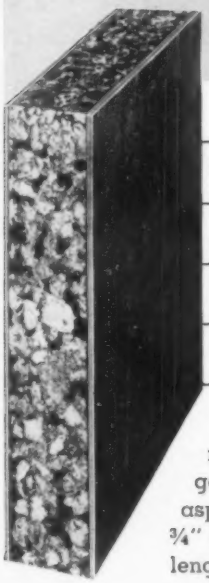

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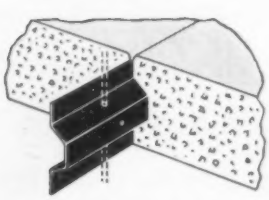

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City Service Commission of Milwaukee, reports the use of a new method of filling drafting positions in the City's Public Works Department. About a year and a half ago, he explains, the first step was taken to train high school graduates, on the job, for journeyman level drafting positions. Before this time, only experienced draftsmen were hired and all were hired at the journeyman level. To make it possible to employ inexperienced high school graduates, two new classes were created with lower pay ranges than the journeyman level drafting class. The department was then encouraged to fill journeyman level positions with high school graduates. These young men were recruited at the lowest pay range with the understanding that they could be promoted while in the same position to the second level and to the journeyman level as soon as they had qualified by examination for appointment to these higher levels. Mr. Braag reports that this program has proved to be very successful, with some high school graduates showing better performance than some more experienced but marginal journeyman level draftsmen.

Chicago Members Hear Traffic Control Discussion

Chicago, Ill.—Over one hundred members and guests attended a luncheon meeting of the Chicago Metropolitan Chapter at the Lake Shore Club on Thursday, April 5. The program included a panel discussion on traffic safety movement and control. William R. Marston, Deputy City Traffic Engineer, presented a paper on "Preferential Street Planning in Chicago," while Ralph Michel, Associate City Traffic Engineer, discussed the operation of the new radio coordinated traffic control signals that have been installed at certain locations in the downtown area. The third member of the panel was Dr. J. Douglas Carroll, Jr., who is staff director for a comprehensive origin and destination traffic study which is now being conducted in the Chicago Metropolitan Area. Mr. Marston said that "The era of patch work traffic engineering on local surface streets is about ended." Here he said, are some of the steps that Chicago plans to take to make local main streets more efficient. "Conflicting traffic movements at principal intersections will be grade separated. Traffic signal time losses at non-grade separated intersections will be reduced by adding more traffic lanes. Safety

Cleveland "80" uses long reach, accurate pipe handling, teams up with trencher on tough 10-mile water line job

KIEFFER BROTHERS, contractors of Mount Carmel, Ill., matched their Cleveland Model 140 trencher and Model 80 side crane against 10 miles of really rough work on a 10-inch cast iron water main job in Loogootee, Ind., this winter. They report their decision paid off well in both time and money saved.

Cutting the 10-mile line through hilly terrain alongside a curving road, Kieffers' trencher maintained a fast, dependable pace overcoming frost and plenty of Indiana sandstone. Despite the tough digging in close quarters, the "140" left a clean trench ready for pipelaying.

Kieffers' "80" kept the pipelaying operation up close, usually only a couple of joints behind the trencher. The one-man-operated "80" picked up the pipe strung along the opposite side of the road, turned on its maneuverable full crawlers and accurately positioned the pipe for fast, easy installation.

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The Model 80's large, easy-acting hydraulic clutches and smooth handling brakes and boom hoist (which placed and held pipe exactly to required positions) also are responsible for its outstanding speed and accuracy when employed as a backfiller.

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will be improved by providing ample pedestrian crossing points and good speed control with a system of progressively timed traffic signals. Fifteen hundred more traffic signals will be installed doubling the present system. The present system will be modernized and many will be interconnected by radio. Old roadways will be redesigned to the best possible standards and, where necessary, alignments of roadways will be changed to permit better design. In redeveloped land areas proper right-of-way will be set aside for future major street construction." The entire program, he said, will be so planned that each construction stage will fit into the ultimate city plan.

San Diego Chapter Members To Attack Common Problem

San Diego, Calif.—The March meeting of the San Diego-Imperial Counties Chapter of the American Public Works Association featured a panel discussion on the topic—"Do We Need Uniformity In Public Works Specifications?" The panel consisted of representatives of contractors, equipment manufacturers, material suppliers, consulting engineers and the U. S. Navy, as well as, officials of the state, county and municipal levels of government. Bruce Hazard of the Hazard Construction Company pointed out that each job must be figured differently when the specifications of the various agencies differ. Standardization of certain types of specifications, he said, would result in fewer errors of bidding and more consistent bidding by contractors. All members of the panel were in general agreement that a Chapter Committee should be appointed to prepare uniform backfill specifications which could be adopted by all agencies in that area. President Virgil L. Larson of the Pacific Telephone and Telegraph Company, stated that such a Committee would be appointed in the very near future.

Explosive Mixtures In Underground Structures

Oakland, Calif.—The last monthly meeting of the Northern California Chapter featured an informative talk titled—"Detection of Explosive Mixtures in Underground Structures," by Mr. Oliver Johnson, Chief Fire Protection Engineer of the Standard Oil Company. Approximately fifty members and guests were present at the meeting. Mr. Johnson explained that considerable effort has been devoted in recent years to means for detecting explosive mixtures which can develop in underground structures because of the entry of natural or manufactured gas, soil gas, industrial gas or liquid fuel. He described many of the techniques used in testing for dangerous mixtures in underground structures and stressed the importance of training all employees working in such facilities to take proper precautions against fire and explosion in order to safeguard life and property.

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Refuse Fill as Helicopter Site

Willesden, England, has for years operated a refuse dump on an area of 22 acres, which has now reached a depth of about 40 ft. Further dumping there soon will be discontinued. It is thought that the dump could be used as a landing place for helicopters, and a small area is being used for that purpose experimentally. The site is on a main highway near London, which makes it advantageous for this purpose.

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Pictured above is a group of once fine and costly INTERNATIONAL axle shafts that have been purposely twisted and broken. This is done to make sure your INTERNATIONAL rear axle will last longer and save you the BIG money—the over-the-years operation and maintenance money.

This rigorous axle-twist test is but one of many operations in the chain of INTERNATIONAL engineering that makes INTERNATIONALS *all-truck*. There are no passenger car compromises *anywhere* in INTERNATIONAL design, no passenger car engines or components asked to do a truck job.

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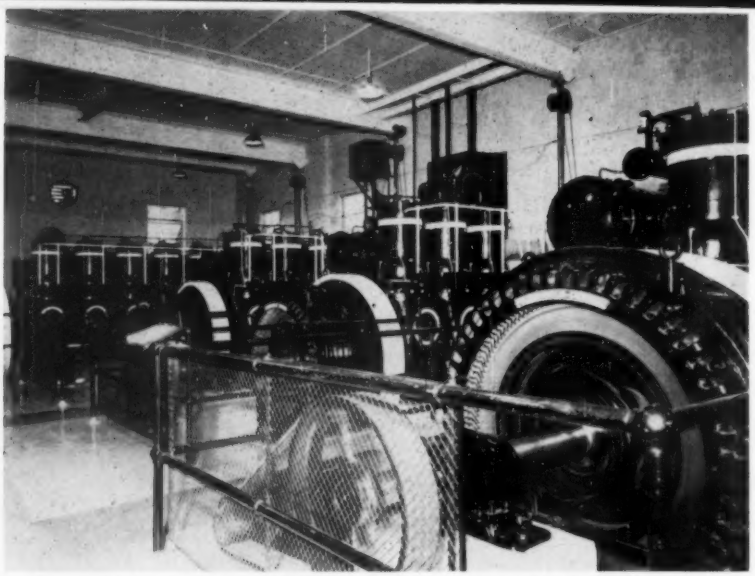

● INTERIOR of engine room of plant. Four diesels supply Woodbine with power.

POWER *is their Business . . . .*

ODD JOBS *a pleasure*

ANY HOUSEWIFE of Woodbine, Iowa, who finds she has a frayed lamp cord or a stalled washing machine to cope with, generally looks out of the window to see if the municipal power plant's service truck is coming down the street. Whether it be the plant superintendent, the lineman, or one of the plant's three operators, Mrs. Housewife can count on him to stop in and put things to rights again before continuing on his way. Lest it be said that that is no way to run a power plant, the office manager at the plant, a lady, is perfectly capable of operating the plant if the regular operator is busy with a maintenance job or is out in town generating good will.

The utility staff, of course, has a full-time job operating and maintaining four Fairbanks-Morse straight oil diesels and a new unit that was installed in October, 1954; but it has made a habit of lending a helping hand to the people of Woodbine, and the community as a whole, since the plant started in 1941. At this plant, the concept of service starts with the primary task of providing a dependable supply of electricity at moderate cost; then extends to helping the customers get full satisfaction with the power they buy. In addition to the power plant, the staff operates the water system, sewers and public parks of Woodbine and when Christmas approaches it turns out in force to string decorative lights over the city's streets. The plant supplies current for the lights during the holidays without charge and, when the holidays are over, the staff takes the lights down again in the same spirit of cooperation.

Throughout the year, the plant lights the city's athletic field when there are night games on the schedule and sends a man to handle the switches for only $10 a night. It lights the city's skating rink and supplies free extra current for religious or civic meetings in the community.

In spite of Woodbine's stable population--holding at 1300 over the last decade—power demand continues to increase. By 1953, the demand was more than 300 percent per capita above 1941 levels and still going up. A survey showed that the largest unit in the plant operated 6,408 hours or 74 percent of the time. A further investigation showed that only during 26 percent of the time could combinations of the smaller three units handle the load. These findings induced the utility's Board of Trustees to approve the purchase of a fifth F-M engine, this time an 8-cylinder opposed-piston unit, and it was installed in October, 1954.

Since natural gas for fuel is unavailable, Woodbine operates exclusively on oil. It uses a 50-50 mixture of Caesar crude oil of 22 to 24 gravity, costing 10.88¢ per gal. delivered, and a heavy cycle gas oil of 20 gravity, at 8.31¢ per gal. delivered. Heavier fuel can be used if necessary.

Fuel is supplied to the plant by tank cars that unload into a 16,000 gal. unloading tank near the tracks. From this tank, the oil is pumped to a 21,000 gal. tank near the plant from whence it flows to the engine day tanks located in a closed pit outside the station building. Fuel passes through a meter, heater and filter before entry into the engines. The fuel heater uses radiator water and the plant keeps the fuel at an even temperature to promote better filtration and atomizing. As a result, the fuel is more completely burned and there is less waste. When the plant installed a fuel filter with a permanent filtering element between the 21,000 gal. tank and the day tanks, fuel pump maintenance dropped 42 percent.

The engines are checked every weekend. Maintenance men clean the fuel nozzles and other working parts as a routine efficiency measure.

Introduction of dual radiators with an automatic control feature has effected a notable reduction in plant use of power. The plant used to run seven motors on the cooling system and consumed 15,000 to 16,000 kw.

For permanent sewers... IT PAYS TO STANDARDIZE ON CLAY PIPE

YSLETA, TEXAS is using Vitrified Clay Pipe *exclusively* in its million-dollar bond-financed sewerage improvement program. The County Water Control and Improvement District installed an extensive system of non-clay sewers in 1948, but has now *standardized entirely on Clay Pipe.* The reason? *Clay Pipe never wears out.* It's permanently safe against disintegration by hydrogen sulphide gas generated in all types of sewage —residential and industrial. Even when exposed to highly corrosive industrial waste, acids and alkalies, Clay Pipe serves for generations without the slightest sign of corrosion. And Clay Pipe is guaranteed for 50 years . . . valuable insurance for any bond-financed project. For sewers that *must be permanent,* always specify Vitrified Clay Pipe.

PROJECT: El Paso County Water Control and Improvement District No. 1

GENERAL MANAGER: Douglas E. Sopher

CONSULTING ENGINEERS: Ashley Clossen & Associates

CONTRACTORS: T. N. O'Kelly; Jack Moore, Foreman

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per month. The dual radiator runs about 15 minutes each hour, and has reduced current consumption to 5000 kw. hrs. per month. Controls start one of the two radiator fans on low speed, then the other on low speed, then the first one on high and then the other on high speed.

Being both an efficient producer of power and a remarkably good neighbor in the community, the Woodbine power plant is naturally a financial success. Its original bond issue of $115,000 was paid off in 11½ years, four years ahead of schedule, and the product it manufactures — electricity — is the only thing the people of the community can buy today that is lower in price than at any time in the last decade. A more tangible sign of its financial success was a new "whiteway" which the utility purchased and installed in the community's business district at a cost of $10,000. The whiteway replaced 28 old street lamps with new electroliers and new lamps, and the utility maintains the new electroliers at no extra cost to the taxpayers.

The plant has given an estimated $33,000 to the city to date in free services and lighting equipment. But that is only a minor part of the services which Plant Superintendent Otis M. Dean and his staff have rendered to the customer-owners of the Woodbine plant.

• • •

Alley Sanitation Includes Weekly Sweeping

Paved alleys, both residential and commercial, are being swept weekly in Beverly Hills, Calif. Refuse must be placed in containers and trees and other vegetation in and along alleys must be kept trimmed. It is intended also to push a program of alley paving.

• • •

Pipe Line Painting in Sewage Treatment Plants

To facilitate identification of piping, especially in large sewage treatment plants, the following color scheme is recommended by the Florida State Board of Health: For sludge lines—brown; gas lines—red; potable water lines — blue; raw sewage lines — green with 6-in. black bands spaced 30 ins. apart; partially treated sewage — green; completely treated sewage—green with 6-in. blue bands 30 ins. apart; compressed air—gray; water lines for heating buildings or digesters—blue with 6-in. red bands spaced 30 ins. apart.

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LOW COST—Provides a combination of advantages not available in other materials at any price.

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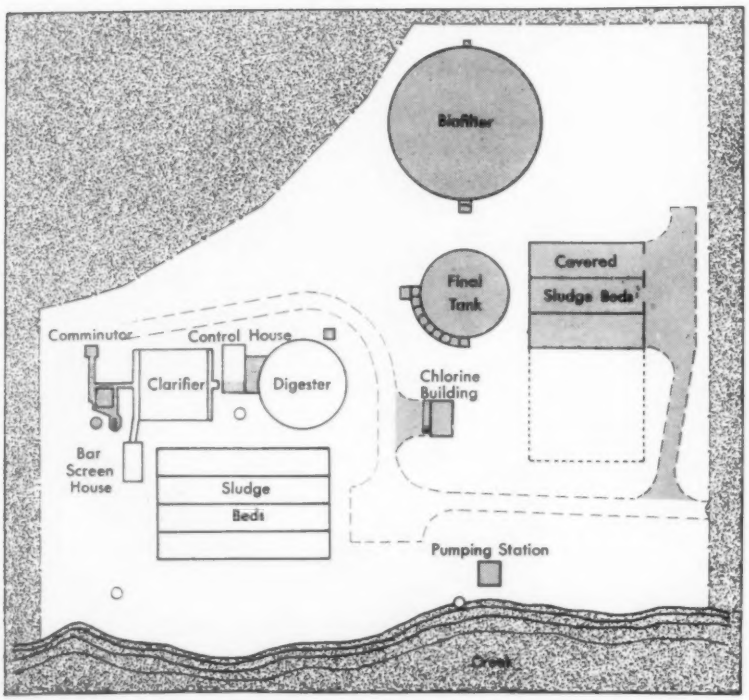


● **SITE PLAN of the sewage treatment plant. Existing primary plant was modernized and a 100-ft. diameter trickling filter provided. Gray tint shows new construction.**

A NEW HIGH RATE FILTER and SEWER SYSTEM

EXTENSIONS TO the sewer system and construction of a modern treatment plant are essential parts of a $990,000 project now under way at Northampton, Pa. The sewer extensions will add 39,791 ft. of 8-in. vitrified sewers and 3,110 ft. of 10-in. In addition there will be 2,973 ft. of 8-in. asbestos cement sewer and 682 ft. of 10-in. Also there are 1650 ft. of 4-in. and 1045 ft. of 6-in. cast iron main. Hot poured bitumastic joints are being used for the vitrified clay lines.

The consulting engineers are Glace & Glace, Inc., of Harrisburg; in charge of the work is H. C. Herbert. Contractors for the sewer work are Schrader & Seyfried, Inc., Bethlehem, Pa., who were awarded the job on a bid of $445,053.30. Bid prices on 8-in. vitrified clay sewers, 0 to 6 ft. in depth, were $3.50; 6 to 8 ft., $3.50; 8 to 10 ft., $3.75; 10 to 12 ft., $4.50; and over 12 ft., $6. For 10-in., comparable prices for the various depths were $4, $4, $4.50, $5, and $7. The 15,355 ft. of 6-in. horizontal house laterals were bid at $3.50 per foot. Manholes per vertical foot were $22, plus $70 for each of the 174 manhole frames and covers.

With 50 percent of the work completed as of early February, rock excavation, on which the bid was $10 per cu. yd., has been running about 9 percent of the total excavation; but this percentage is expected to increase sharply on the remainder of the project.

Currently, the contractor has been using three large backhoes, two small backhoes and one lateral trenching machine. High water has interfered somewhat with the work, particularly on an interceptor along the canal. During Hurricane Diane, the contractor lost much of the pipe that had been strung along the ditch.

The Treatment Plant

The existing primary treatment plant is being improved and modernized. This work is being done by Vanguard Construction Co. on a bid of $261,728 which includes three sewage lift stations.

The existing rectangular primary clarifier is 40 by 40 ft., 7 feet deep. Secondary treatment is provided by a biofilter 100 ft. in diameter, and 3.3 ft. deep. The final settling tank is circular, 50 ft. in diameter by 9 ft. sidewater depth. The digester is 50 ft. in diameter and 15 ft. SWD. Sludge beds are provided, both open and glass covered, with a total area of 9,600 sq. ft. The comminutor and the sewage pumps were furnished by Chicago Pump Co.; the detritor, clarifier mechanisms, distributors and digester equipment was supplied by Dorr-Oliver. Chlorinators were furnished by Wallace & Tiernan; and the sludge bed covers by Metropolitan Greenhouse Mfg. Co. Other plant contracts were for plumbing to Vanguard Constr. Co., at $3,970; for heating and ventilating to Lehigh Engineering Co., at $3,904; and for electrical work to H. N. Crowder, Jr., at $8,781.

Financing

The work is being paid for by the issuance of revenue bonds totalling $990,000. This will be paid off by sewer rentals which are fixed at 115 percent of the water bills; and by charges of $115 for connection fees to individual users. In addition, there will be a small grant from the state, as provided in an act passed in 1953. This will amount to about $6,600 per year.

● **CLAY PIPE placed ready for work.**

• • •

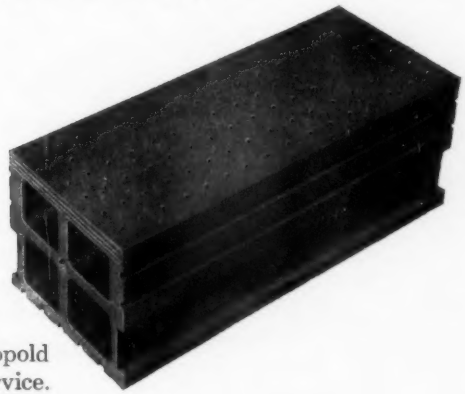
Dewatering a Digester

A digester at the Detroit sewage treatment plant had to be dewatered, due to poor heating. It was drawn at predetermined rates to the plant effluent "and no difficulty was experienced in the grit chambers or sedimentation tanks. The large volume of scum and oil was skimmed from the tanks and burned."

A GOOD COMBINATION

for better performance— lower operating costs...

LEOPOLD FILTER BOTTOMS



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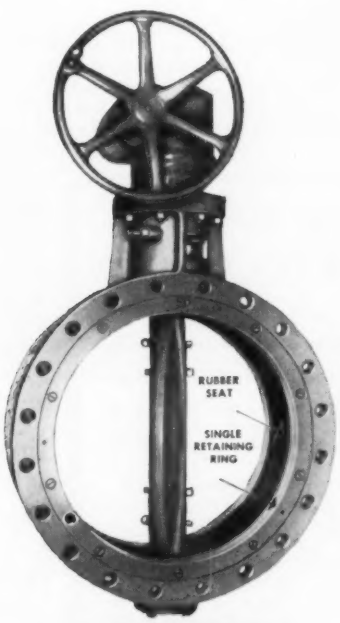
Made of de-aired fire clay—vitrified and salt glazed, the Leopold Filter Bottom is unequalled for dependable, economical service. The individual blocks resist corrosion, are not subject to tuberculation, and will last indefinitely. Too, they require only small sized gravel, do not need special supporting concrete members, and the Leopold design insures uniform wash distribution.



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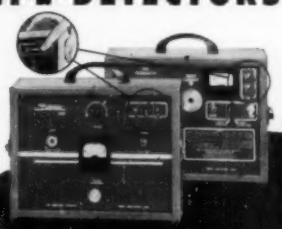

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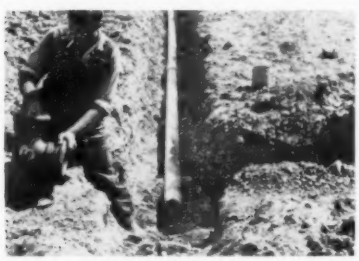
MUNICIPAL GOLF COURSE BUILT ON WASTE LAND

MARK HANNA

City Engineer, Alameda, California.

INCLUDED WITHIN the political boundaries of Alameda, California, but isolated geographically by reason of its lying across a narrow, bridged strait of San Leandro Bay, is an area known as Bay Farm Island. The "Island" technically speaking, has long ceased to be such, as the sloughs which separated it from the mainland have been filled for more than twenty years.

The gradual development of the land forming Bay Farm Island originally posed many difficulties for Alameda's City Engineers. Somewhat inaccessible by reason of an ancient, decrepit swing-span bridge, since replaced, it consisted of several hundred acres of rich truck gardens and about three times this area in barren marshland. Since the elevation of most of the barren land was below high tide water level, drainage was a continual problem. Winter gales were a perpetual flood menace. Paradoxically, however, over the years persistent rehabilitation of the once valueless wastelands has boosted the site out of the "headache" class and into the category of civic pride from both esthetic and financial standpoints..



● **DRAINAGE was facilitated by use of special pipe with a snap-on joint.**

Since most of the Island of Alameda was already occupied by homesites, real estate promotors years ago surveyed and graded several hundred acres of the marshland on Bay Farm Island hoping to persuade buyers to settle upon this annex. The scheme didn't "take"; in consequence, the vast majority of reclaimed land remained bare and unwanted. When, eventually, the City acquired the property, citizens voted down a proposition to turn it into a golf course feeling, apparently, that further development would be expensive and futile. However, municipal authorities plus a handful of interested and determined citizens, instituted small-scale horticultural experiments. Finally, after digging a well and establishing a sparse but satisfactory wind-break of shallow rooted shrubs and trees, a few holes were installed and the local golfers invited to try them out. As these initial holes were successful, the adjoining undeveloped land was gradually transformed into a gently rolling series of park-like fairways, carpeted with grass and planted with trees and shrubs. Here and there, former sloughs were retained to create water hazards. This course has proved so popular through the years that Alameda voters recently approved a bond issue of some $700,000 to provide an addition of 18 holes, with a new clubhouse to augment the original full-scale course.

The new project was complicated by the existence of neighboring aircraft control towers and instrument stations which are sensitive to the presence of such objects as construction equipment, lawn mowing machines and automobiles. Hence, the architect's layout had to meet the proximity limits established by the Civil Aeronautics Authority.

The first contract of $20,000 was for storm drainage pipes and ditches; minor ditching, however, was economically accomplished by City supervision of rented equipment. Next, and in conjunction with work already in progress, about 2½ million gallons of entrapped water was removed from a slough adjacent to a fairway of the existing course and a sanitary landfill was made, using about 40,000 cu. yds. of refuse as a sub-grading mat. This waste material was supplied free by the

● **MODEL aircraft flying field is a product of the new method of refuse disposal.**

Oakland Scavenger Co., which normally doesn't operate within Alameda City limits.

Although it is estimated that about 150,000 cu. yds. of refuse will finally be used on the completed job, native soil or imported fill at 60¢ or 70¢ per cu. yd. has been used in remote areas or in building mounds and obstruction hazards. Greens have been overlayed with a drainage blanket of 3 ins. of ¾-in. screened gravel plus 8 ins. of topsoil; the latter was delivered at an average cost of about $1.83 per yard.

At one location, the layout of the new course required transferring an existing model airplane flying field to a new site several hundred feet away across a busy highway. Since the new location adjoined the existing city dump, the model plane field's circular area of 83-ft. radius, plus a 10-ft. apron, was brought up to grade by the use of burned and decomposed refuse plus a blanket of topsoil.

When drainage and grading of the first nine holes were nearly completed, a contract was let for the installation of underground sprinkler pipes and a well for irrigation. The sprinkler system was first installed with its "lock-twist" type couplers extending a few inches above the ground for visibility. Later, however, they will be lowered to about a half an inch below the surrounding surface. The well, consisting of a 14-in. casing within a 24-in. diameter shell, brought in some 1600 gpm of clear, fresh, sand-free water at a depth of 518 ft.—an amount more than adequate for the pumping plant which is designed to handle from 750 to 1350 gpm. As a side issue it is interesting to note that the well on the existing course, drilled to a depth of 499 ft., produces an average of 500 gpm for fourteen hours per day. The need for such large quantities of water lies in the fact that the region is quite windy and, hence, unusually susceptible to rapid evaporation.

For the overall design and layout of the new course, the City of Alameda engaged the services of Wm. Bell, Jr., of Pasadena, an expert in this field. However, as the job progressed, various adjustments of contours were made under the guidance of Earl Fry, City Golf Professional, who has been in charge of the original course since its early days. Technicalities, as they arose, were handled on an individual basis by the City Engineer's Office. Lawn seeding, for instance, was done after consultation with university, county and golf association experts and advice from five commercial seed concerns. Plans and schemes for the most efficient and economical drainage were developed after considerable engineering studies and consultation with the landscape architect.

During the several months in which the new course has been under construction many problems have developed; but in keeping the construction program flexible and working with all groups concerned many solutions have come about painlessly. Much work remains to be done before the entire course will be completed but if the patronage of 125,000 golfers last year at the old course is indicative, the effort will be well worthwhile.

• • •

Cost of Installing Water Meters

During the past fiscal year, Detroit Water Department installed 3,002 ⅝-inch water meters at an average cost of $19.94, of which $1.19 was for labor; 793 ¾-inch meters cost $29.04 each installed, including a labor cost of $1.34; 596 1-inch meters cost $43.61 installed, with labor at $1.98. Other meter costs installed were: 1½-inch $81.04; 2-inch $119.96; and 3-inch compound $424.49.

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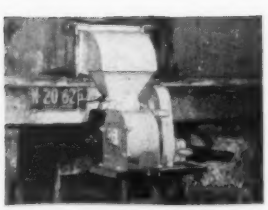
Two models: *Hydraulic Model 55-H* (shown), cab-controlled; attaches to any hydraulic-lift dump truck; adjustable volume control; directional vanes control spread pattern. *Auxiliary Engine Model 55*, clamps to tailgate of any dump truck. BULLETIN A-401.



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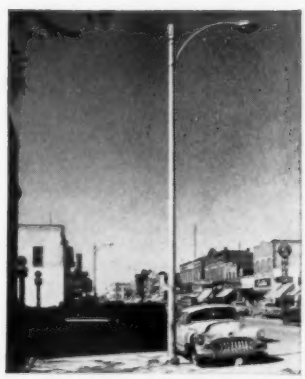

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Installation of Gas Pipeline Not Included in Private Easement for Highway Purposes

IN A RECENT New York Appellate Division case, the court held that where an easement is taken for highway purposes only such uses as appertain directly or indirectly to the right of passage and tend in some way to preserve and make easier the exercise of such right, may be included within the easement. For other uses, the landowner is entitled to additional compensation.

Plaintiffs were the owners in fee of a portion of the property involved, but their deed contained a reservation excepting a part of their land for highway and street purposes. The present owners of the "easement," or exception, sought to install and maintain a gas pipeline below the surface of the street for the purpose of supplying gas for domestic use in certain houses which they owned. There had never been a dedication of this street and therefore the public never acquired an interest in it, said the owners.

The owners of the fee sought an injunction requiring the owners of the easement to remove the gas pipeline and meter from the street. The issue before the court was whether the gas line installation in the street constituted an additional burden upon the fee for which the owners of the fee were entitled to compensation. The resolution of this question depended upon the further question as to whether such installation is a street use and deemed to be within the grant of defendant's easement for street and highway purposes.

The court found that there is a well established doctrine that such use is not incident to a street easement and is therefore not within the grant of the easement. It noted that the use does not tend to improve the use of the street. The court was a little hesitant in reaching its decision pointing out that:

Under modern conditions we have perhaps arrived at a time when the definition of "street use" should be expanded to include the installation of poles, pipes, conduits, and tubes for various municipal uses, such as steam, electricity, telephone and gas, which would not impair the public easement. Even so, such a deviation from long established propriety is not justified or required under the circumstances here presented where a mere private easement for street purposes exists over the land of another. The Court concluded that the owners of the easement had exceeded their rights under said easement and injunction asked for by the landowners should be granted.

• • •

Combustible Rubbish Study in Los Angeles

The Los Angeles Board of Public Works report on the pilot combustible rubbish project being conducted in the Harbor area indicates that the cost per ton for both collection and disposal has slightly decreased. After the first two months of operation through January cost per ton was $13.25. Now that the figures are available for February, the average cost per ton for the three months has come down to $12.82.

These figures include all costs, both direct and indirect. Not only have the dump charges and incineration charges been taken into account, but also such items as retirement cost on salaries of employees, equipment depreciation, Bureau administration, Departmental administration, and General City administration.

It should be noted that the cost per dwelling unit, now 32 cents per month, and cost per capita, now 10 cents, are based upon the number of

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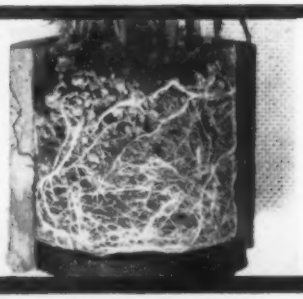

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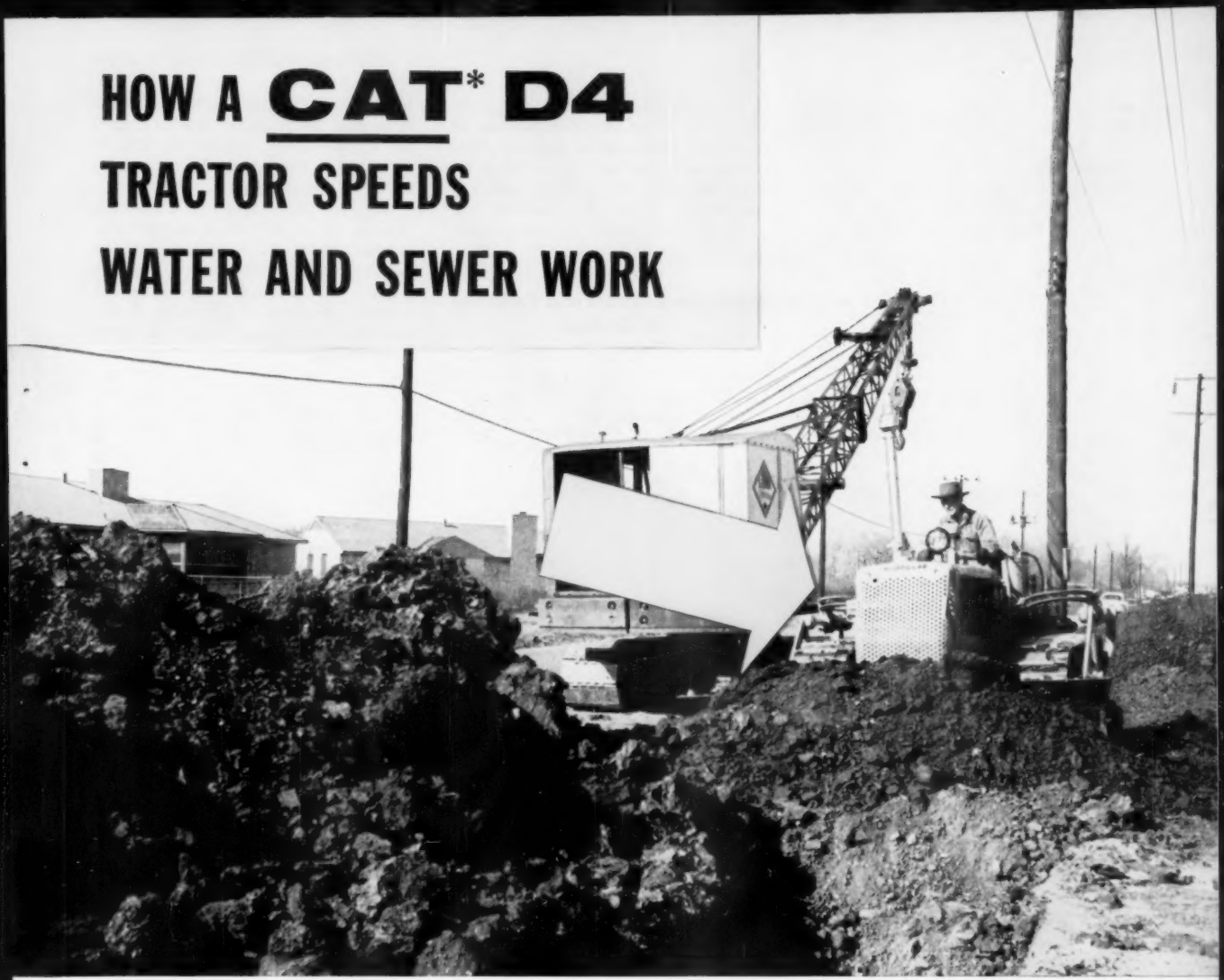

In the whole Caterpillar line of crawler tractors, the D4 probably best fits the needs of the average municipality. It's big enough to do a multitude of jobs well—small enough to give maximum economy and mobility.

The D4 Tractor with No. 4A Bulldozer shown here is owned by the City of Tulsa, Oklahoma. On this particular job the city is laying 16,000 feet of 24-inch water main. All the backfilling is handled neatly and quickly by the Cat-built unit.

There is plenty of work all year round for such a machine. It can be used not only for water and sewer jobs but for stockpiling road materials, feeding the shovel in gravel pits and removing snow in winter.

The D4 is ruggedly built to stand up in tough going. Its dependable 4-cycle, 4-cylinder engine delivers 50 drawbar HP at 1600 RPM. The Caterpillar fuel injection system is simple and foul-free, permitting the use of thrifty, low-cost fuels. Five forward speeds give the tractor a range up to 6.1 MPH.

Final drive, track rollers and idlers are equipped with bellows-type seals, effective in keeping out mud and dust and lengthening work life. Operators like the D4's seat comfort, good visibility and ease of operation and maintenance.

Check over your equipment now. If you're in the market for an all-around tractor-bulldozer unit, give your Caterpillar Dealer a call. He'll be glad to demonstrate a machine on your job and prove with actual figures how it can save the taxpayers' money. He backs the equipment he sells with reliable service and parts you can trust.

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dwelling units and total population in the area of the project. Data are not yet available as to the exact number of residences from which rubbish is removed on each collection and during each month. It is expected that this data will be obtained before summer.

Costs are reported as a result of actual operations and should not yet be used as an indication of cost of City-wide service. Such determination must await additional experience during coming months when volume per dwelling will probably increase. Also other factors will have to be taken into account such as the effect of complete elimination of backyard incinerators, hauling distances and cost of incineration in other sections of the City, and the availability of transfer stations and dumps to be operated by the County Sanitation Districts.

• • •

Sanitation Progress and Problems In El Paso

Since 1945, El Paso, Texas, has increased its area from 8,736 acres to 43,360 acres—about 500 percent. This has necessitated a revolution in refuse collection work. The problems and the progress are described in an excellent report by Ed F. Muckelroy, Superintendent, Department of Sanitation.

In 1945, there were 18 collection trucks, all of the open or partially covered type; none of the modern packer-type. In 1955, there were 31 trucks in service on collection routes, all modern. Of these, 8 are Gar Wood; 3 were Leach; 22 were Pak Mor; one was Hyde-Pack; and one was Seal Press. The latter two have 20-yd. bodies. It has been the experience that, with bodies of the compactor type, three times as much yardage can be handled as in an open body. Five other packer-type units are assigned as spares and for special service.

With these units in service, four times as much refuse is being handled as in 1945—about 1600 yards a day. This has been accomplished with an increase in personnel from 48 in 1945 to 108 in 1955; and with a budget increase from $170,000 to $438,243. More important, collections are on a carefully maintained schedule; work hours have been reduced to 44 per week from 48 and pay has been increased.

Disposal is by sanitary fill. About 2,000 cu. yds or 350 tons per day are handled. Fill equipment comprises two tractors with bull clams. Because of the area to be served, travel is being reduced by starting subsidiary disposal areas in outlying districts. At present, these are "burn and bury" operations, with metal salvage. The first month of operation at the new Desert Road station brought in $110.

Brush crews hauled 3,600 loads of brush, each of 10 cu. yds. A brush chipper is used to reduce this brush to chips.

There are five street sweepers, one Wayne and four Elgin; the Wayne is a double-brush machine used especially for sweeping one-way streets. In all, 33,864 curb miles were swept in the past year compared to 23,524 miles the preceding year. The major part of this increase is ascribed to the installation of a recording device which shows the number of hours and minutes the machine is in forward motion and also the time the sweeper is standing still. This is made by Service Recorder Co.

Other equipment owned by the Department, in addition to trucks, includes a Le Tourneau 7-yd. carry-all; 2 sewer cleaning machines; a ⅜-yd. Allis-Chalmers loader; a 500-watt F-M generator; a Jaeger dewatering pump; and a chain saw.

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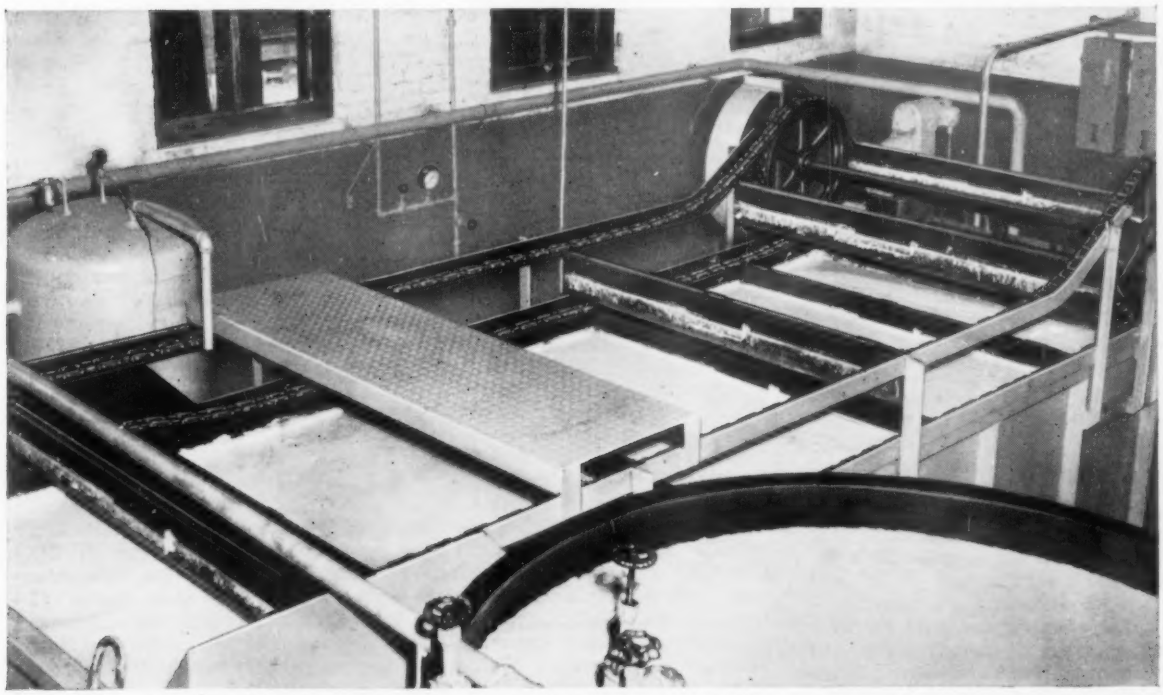

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PUBLIC WORKS DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Designing Sedimentation Basins

The author gives a mathematical analysis of sedimentation of sewage in basins, comparing the efficiencies of long rectangular tanks and circular ones. He disputes the claims made, on the basis of dye tests and the effect of inlet and outlet zones in decreasing sedimentation, that long, narrow rectangular tanks are vastly superior in performance to radial-flow tanks.

"Flow Path Effect on Sedimentation." By E. B. Fitch, of Dorr-Oliver, Inc. *Sewage and Industrial Wastes*, January.

Leaves and Sludge Compost

Birmingham, Mich., makes a compost of sewage sludge, leaves, and wood chips, which is gladly used by its citizens on gardens and farms. A trench about 250 x 50 ft. x 4 ft. deep receives leaves collected in the fall and tree branches which have been passed through a chipper, compacted by running a bulldozer over them. Wet digested sludge is brought in a tank and poured on top of the leaves until the trench is full. Water from the sludge soaks down through the leaves and by the next fall the mass is dry enough to be pushed out of the trench by bulldozer into a pile. The money obtained by selling this compost did not seem worth the bother, and it is free for all to come and get it. By June it is usually all gone.

"Sludge — Help Yourself." By Russell Grinnell, Supt. *Wastes Engineering*, March.

Aeration in Activated Sludge Treatment

Research on oxygenation with air bubbles by the Health Research Council of the Netherlands has led to conclusions that aeration with small air bubbles is more effective than with large ones; that the rapid tank circulation with diffused air aeration is decidedly detrimental to the amount of oxygen passing into solution. The absorption of oxygen at the surface of the aeration tank is of minor importance. In the case of low air diffuser resistance, shallow aeration tanks (1.5 to 2 meters deep) are more economical than deeper ones, especially when aerating with small air bubbles.

"Research on Activated Sludge." By A. Pasveer, of National Health Research Council. *Sewage and Industrial Wastes*, January.

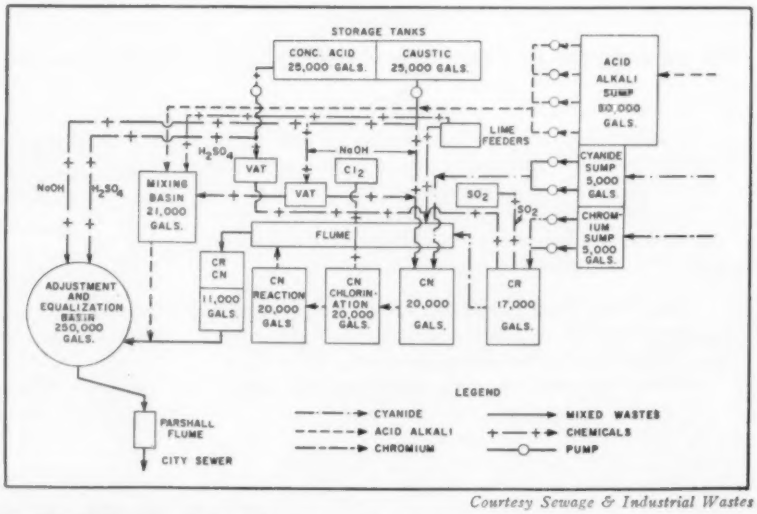
Storm Drainage Design Practices

In response to a questionnaire sent to a large number of cities asking what rate of rainfall is used, and what formula, in designing storm drains, many reported that they used the Talbot formula for rainfall. Runoff is calculated by the rational method, or by the Burkli-Ziegler, the McMath or other formula. This article gives the data furnished by cities in Alabama, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Washington and Wisconsin.

"Storm Drainage Design Practices for Cities." PUBLIC WORKS, April.

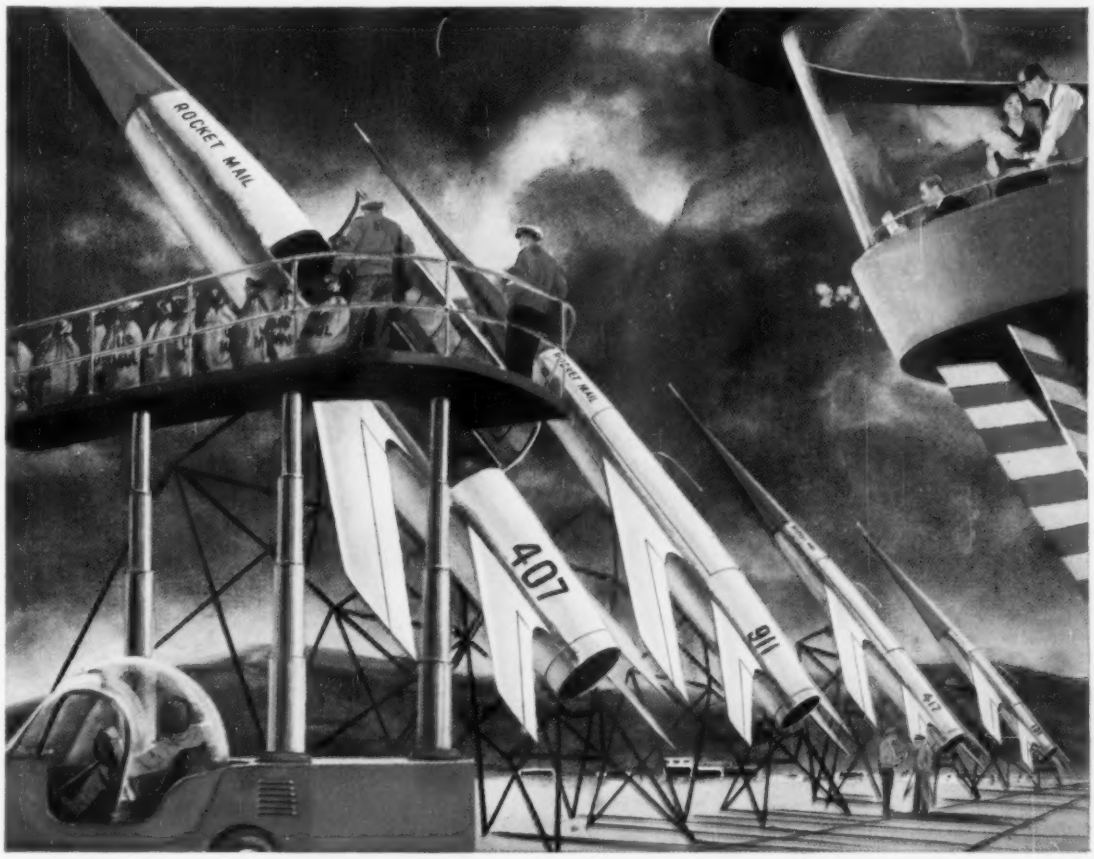
Home Garbage Grinders at Jasper

In March, 1950, Jasper, Ind., began the installation of home garbage grinders under municipal supervision. In June, 1955 there were approximately 1,000 in use, and practically all new houses are so equipped. This has provided a sanitary means of garbage disposal and helped greatly in improving general sanitation in the city. However, it would be difficult if not impracticable for some cities; the disposal of trash remains to be solved. At the sewage treatment plant, air requirements per pound of BOD removed are more than were anticipated in the original design (1.4 cu. ft. per gal of sewage); the percentage of suspended solids removed in the primary settling tanks is good. Gas production is considerably high-



Courtesy Sewage & Industrial Wastes

● **FLOW diagram of the industrial waste treatment plant of GE at Louisville, Ky.**



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er than in plants not handling garbage. Deposits have collected in the sewers but are readily flushed out during a rain; and such deposits create no problem.

"Garbage Grinder Experiences, Jasper, Ind." By Frank D. Wraight, Ind. State Board of Health. *Sewage and Industrial Wastes*, January.

Slime Formation In Sewers

Laboratory and field studies lead to the conclusions that the nature and degree of roughness of the submerged surfaces of sewers do not affect the ultimate quantity of slime growth except during the initial period. Aerobic environments produce more slime than anaerobic environments. Slime growths apparently increase when the food supply is reduced. During the primary slime formation period, velocities of 0.4 ft. per sec. gave greater amounts of growth than higher velocities, but after this, higher velocities induced greater growths. Slime growths are cyclic; the initial lag period is followed by a rapid accumulation, and this by a sudden decrease attributed to the sloughing of the attached growths. This phase is not followed by another lag period but by another period of rapid accumulation and then by another sloughing.

"Slime Formation in Polluted Waters." By H. Heukelekian and E. S. Crosby, of Rutgers Univ. *Sewage and Industrial Wastes*, January.

Irrigation With Sewage Effluents

Land treatment of sewage is as old as sewage disposal itself. New methods of using sewage effluents for planned irrigation, with emphasis placed on conservation and on agricultural utilization, is a recent development. Methods employed in a number of cities in Germany are described. The two principal types of irrigation employed in this country are the spray system and the broad surface method. The former is the latest and most successful; its use for milk processing wastes has been put into operation in several states during the last five years. The broad surface methods include the ridge and furrow and flood irrigation. As a new science, irrigation with sewage effluents is still in the experimental stage and many problems need to be solved in the fields of bacteriology, biology, hygiene, soil structure, and the physiology of plants.

"Irrigation With Sewage Effluents." By Bernard P. Skulte. *Sewage and Industrial Wastes*, January.

Test shows Coleman is best buy

To measure minerals in water at 0.1 PPM Industrial Filter & Pump Mfg. Co. chose a Coleman Spectrophotometer

"We tested various instruments and selected the Coleman Universal Spectrophotometer as best for our needs," said the head of Industrial's Water and Waste Treating Division. "In our analyses for sulfates, phosphates, silica, manganese, iron, turbidity and color, the Coleman has cut our analysis time in half, allows us to use smaller samples and to conveniently run 20 or more samples at one time."

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The diffraction grating creates a true undistorted spectrum, unlike prisms whose spectrums appear condensed in the short wavelengths, much wider in the longer ones.

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Clarification By Flotation

The Racine, Wisconsin, sewage treatment plant, finding that its clarification basins were unable to handle satisfactorily the increasing amount of sewage, began in May, 1954 a study of the practicability of increasing their capacity by substituting flotation for sedimentation, by operating a pilot plant. From the results of this test they concluded that the depreciation and power costs of the two methods of solids removal favor the conventional system by $94 a year. If interest on the investment is included, the flotation system, costing only $50,000 for conversion of one of the present tanks to flotation, is favored by $7,439.

"Air Flotation Studies of Sanitary Sewage." By Thomas T. Hay, Supt. of Sewage Disp. Plant. *Sewage and Industrial Wastes*, January.

Gas Recirculation In Digestion Tanks

Four digestion tanks at Maple Lodge Works, England, were put into service in May, 1951. The mixing of incoming primary sludge was inadequate and in 1953 inspection of one tank revealed a scum blanket 7 to 8 ft. thick, containing 21 percent solids with 70.2% of volatile matter. Several methods were tried for obtaining better mixing, but none was successful. By 1954 the scum depth had reached about 10 ft. Learning that success under similar conditions in the United States and Canada had been obtained by blowing sludge gas into digestion tanks, this was tried at Maple Lodge. The author describes the method developed for effecting this; adding that after this was in successful operation they received a copy of *Sewage and Industrial Wastes* for April, 1954, where R. E. Fuhrman described an arrangement identical in all except minor details with that finally adopted at Maple Lodge. There the process has been "most successful." The problem of scum removal has been solved, and the digested sludge is more easily dealt with on vacuum filters.

"Experiments with Gas Recirculation in Sludge Digestion Tanks." By J. Griffiths and J. Withnell. *Contractors Record*, Feb. 22.

Hydrogen Sulfide Generation in Sewers

In a free-flowing sewer there will be no sulfide formation if the sewage gets enough oxygen from the atmosphere above the flowing stream. This will occur if the velocity of the sewage in feet per second equals the square root of (BOD) $1.07^{T-20} \div 55$, where T is the centigrade temperature. Where this velocity is not attainable, preventive measures suggested are pumping compressed air into the sewer; keeping them clean; and occasional removal of slime by introducing into the sewer lime or other material such as chlorine, or sodium nitrate. In Los Angeles, manholes are protected by hanging in them a can of ammonium carbonate.

"Control of Hydrogen Sulfide Generation in Sewers." By Richard D. Pomeroy, chemical engineer. *Water & Sewage Works*, March.

Standardization Of Utility Designing

Standardization of designing procedures helps public works departments provide more service at less cost. This is illustrated by Baltimore County's Metropolitan District, which contains a population of over 270,000 on 254 sq. mi. In 1948, to meet the increasing demands on the county's engineers, the Dept. of Public Works coordinated the work of this district, the road department, the buildings and zoning offices and the sanitation division, and prepared design standards for

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Complete line of double-suction split-case single-stage, two-stage, end suction, axial flow, sludge, and deep well turbine pumps—for wide range of raw water, low lift, high lift, backwash, and general service pumping requirements. *Send for Bulletins 248A, 246A, 251A, 245A.*

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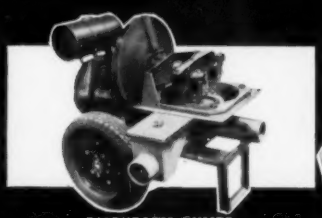

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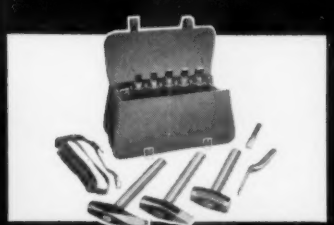

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PIPE LINE EQUIPMENT

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its own staff and private engineers. A Baltimore firm of engineers was engaged to provide a guide for standardizing all utility, road and bridge designs. The standards have been published in two volumes—a "Standard Design Manual" and one of "Standard Details." A designer, by following the procedures and design criteria set forth, can initiate a utility design and carry the project through to contract bidding. The design manuals will, it is anticipated, be available for the use of all design personnel within the county, consulting engineers and construction forces.

"Standardization of Utility Design Procedure." By A. R. Vollmer and J. G. Peeler, Jr., PUBLIC WORKS, April.

Other Articles

"Three Strikes Against Water Pollution." **Philadelphia** completes treatment of all its sewage in a 10-yr. period, financed by sewage rentals. Engineering News-Record, March 8.

"Engineering Solves the **Refuse** Problem in Atlanta." Incineration produces profitable steam; land filled with dry refuse. By Guy Browning Arthur. Public Works, April.

"Good Design Reduces Sewage **Pumping Station Costs**" in St. Louis, Mo. By Frank J. McDevitt, Pres., Board of Pub. Service. Public Works, April.

"Elliptical **Sewer in Tunnel** Saves Time." Shape of concrete pipes permits carrying individual units through completed sewer to head of tunnel. By A. J. Mair. Public Works, April.

"**Detergents** Not Necessarily Guilty" of foaming, conclusion by Ass'n of American Soap Producers. American City, March.

"**Westchester County** (N. Y.) Solves Some Sewerage Problems." By Guy Griffin and James Brown, of New Rochelle Sew. Treat. Plant. Sewage and Industrial Wastes, January.

"Design of Plain **Settling Tanks.**" Chapt. 16 of a practical manual for operators. By Leroy W. Van Kleeck. Wastes Engineering, March.

"An Investigation of the Treatment of **Cabin Cruiser Wastes.**" By William T. Ingram, Adjunct Prof. **New York** Univ. Sewage and Industrial Wastes, January.

"Salt Marsh **Mosquito Control** Program in Kentucky." By Ralph C. Pickard, of Kentucky State Dept. of Health. Public Works, April.

"**Preventive Maintenance** Pays Off in Cicero", Ill. Describes program for keeping the sewer system clean. By George Diamond, Supt. Eng., Water & Sewer Dept., Chicago. Public Works, April.

"Weir of Special Design for **Grit Channel** Velocity Control." Mathematical development of a formula. By Robert L. Gordier, Chain Belt Co. Water & Sewage Works, March.

"Modern Sewage Facilities for **Tucson** (Ariz.) **Metropolitan Area.**" By Laurence O. Henry, District Eng. Water & Sewage Works, March.

• • •

5-Year Improvement Program for Chicago

An expenditure of $154,536,000 is planned for the Chicago water system for the 1956-1960 period. This program includes a 16-ft. and a 12-ft. tunnel, total cost $18 million; a ground reservoir at $2 million; the Central District filtration plant and connecting tunnels which is estimated to cost $80.6 million; and additions to the South District plant at $5.3 million.

Pumping station improvements will cost about $17.5 million and will include four 40-mgd steam turbine pumps, five 50-mgd, two 60-mgd, three 85-mgd and two 80-mgd pumps; also boilers and pump station construction. Water main construction is estimated to cost $31.1 million.

THE NEXT FEW MINUTES...

DETERMINE A SEWER'S VALUE TO YOU!

When that cloud finally bursts and torrents of water pour down on grounds and streets, you'll know in short order if your sewers are operating at full capacity. But then, it may be too late to do anything but listen to hundreds of complaints about flooded basements and streets.

A contract with National Power Rodding Corporation, specialized pipe cleaning engineers, is the best insurance you can have against obstructed sewers. Patented Power Rodding, powerful bucket and brush drag-line operations, and skilled action by experienced engineers combine to restore sewers to maximum flow capacity regardless of the severity of the blockage.

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Suggested Specification for Testing Sewers for Watertightness

A SECTION OF sewer line shall be prepared for testing by plugging the upper side of the downstream manhole and all openings in the next upstream manhole except the downstream opening. Where grades are slight, sections between two or more manholes may be tested at once. Where grades are steep, and excessive test heads or overflow of the downstream manhole would result by testing the full distance from one manhole to another, test tees the full size of the main shall be installed at intermediate points so the maximum head on any section under test will not exceed 12 feet or the depth of the lower manhole, whichever is less. Branch sewers running from Y-branches on the mains shall be plugged at their upper end if the test head would cause them to overflow.

A section of sewer line prepared as above shall be tested by filling with water to an elevation of four feet above the invert at the midpoint of the test section, or four feet above the existing ground water elevation, whichever is greater. The water should be introduced into the test section at least four hours in advance of the official test period to allow the pipe and joint material to become saturated with water. At the beginning of the test the elevation of the water in the upper manhole shall be carefully measured from a point on the manhole rim. After a period of one hour, or less with the approval of the engineer, the water elevation shall be measured from the same point on the manhole rim and the loss of water during the test period calculated. If this calculation is difficult, enough water shall be measured into the upper manhole to restore the water to the level existing at the beginning of the test, and the amount added taken as the total leakage.

Should an initial test show excess leakage in a section of line, it is permissible to draw the water off and test the manhole that contained water. This test shall be made by plugging all the openings in the manhole and filling with water to the same elevation as existed during the test. The leakage from the manhole may be deducted from the total leakage of the test section in arriving at the test leakage. After the testing is complete the manhole shall be waterproofed, if leaking more than the permissible amount, by grouting and/or painting the interior with sodium silicate or other approved water-proofing agent.

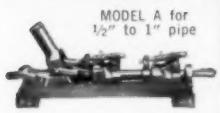
The allowable leakage in the test section shall not exceed 400 gallons per mile per day per inch diameter at the above four-foot test head. If it is necessary or desirable to increase the test head above four feet, the allowable leakage will be increased to allow for the increase in head.

Sewer sections showing leakage in excess of that allowed shall be repaired or reconstructed as necessary to reduce the leakage to that specified above.

All tools, materials and appurtenances required for testing the sewers as specified shall be furnished by the contractor, and shall be included in the price bid for the work.

This is a suggested testing specification drawn up by Sealite, Inc., 8923 San Leandro St., Oakland, California. It was sent to us by John A. Griffith, Phelps-Drake Co., Inc., Minneapolis, Minn. The original wording has been modified slightly.

Trojan Pipe Puller & Pusher
installs or renews pipe under pavement
in half the time required by any other machine!



Exclusive continuous action, which eliminates all resetting of grip, does the trick!

The Trojan combines pushing and pulling operations in one machine —keeps pipe continuously moving —lets you install 40′ services in as little as 20 min.

Model A needs only 5′ trench. One man can easily install the average service. 15 tons of pushing pressure possible.

Model B is reversible in 30 seconds—has 3 speeds for different soils. New dog with individual inserts cuts maintenance.

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Elevated bituminous mix plant

KWIK-MIX Bituminous Mixers set up anywhere for economical, one-man handling. Both 10 and 14 cu. ft. sizes are readily adaptable as stationary, elevated plants. Operator controls charging, mixing and discharging without leaving platform. Skip, receiving aggregates from truck at ground level, is raised by power up an extension track to charge drum. Non-tilting drum discharges mixed batch into trucks or hoppers in 6 seconds. Mixers also mount on rubber tires for mobile, on-the-job mixer service. Ask Kwik-Mix distributor for details, or write for catalog.

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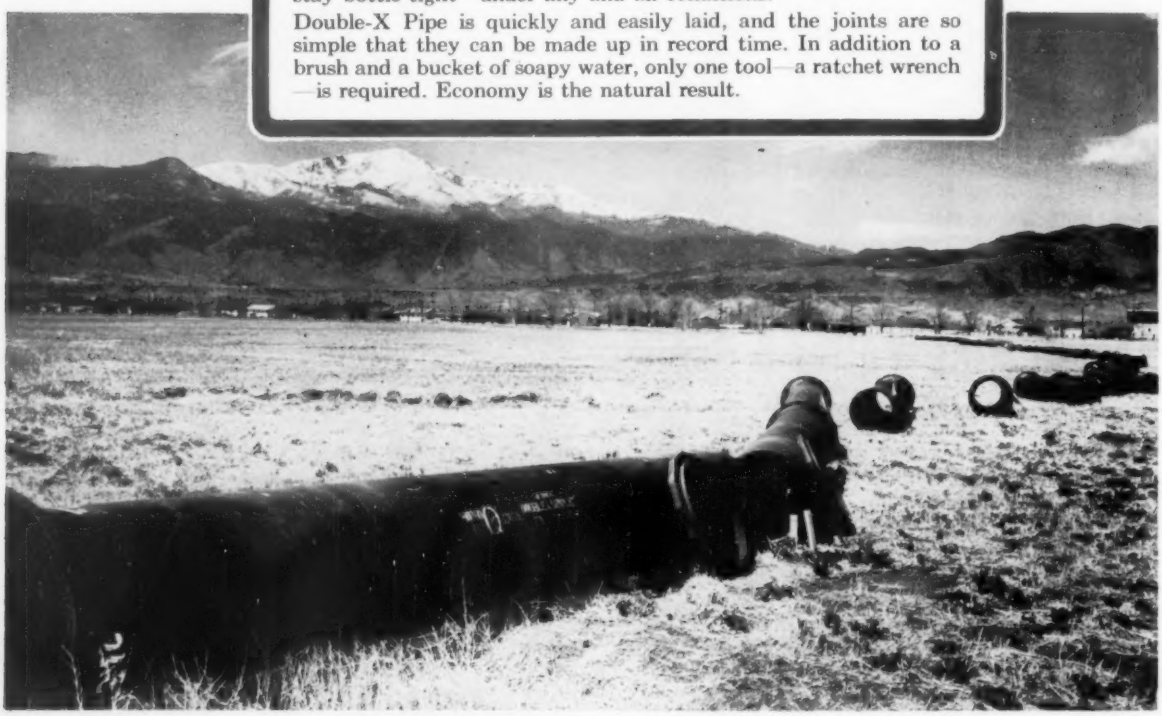
American Double-X Mechanical Joint Pipe

American Double-X Mechanical Joint Pipe is proving its economy, versatility, and ruggedness in installations such as the new water supply line in Colorado Springs. Throughout the country, versatile American Double-X Pipe is successfully conveying such varied liquids as sour naphtha, sewage, water, gas, crude oil, salt brine, and gasoline.

The American Double-X joint is scientifically designed with a stuffing box into which an endless ring gasket is compressed by a cast iron gland. It allows ample deflection as well as expansion and contraction of the line without leakage. Rugged Double-X Joints stay bottle-tight—under any and all conditions.

Double-X Pipe is quickly and easily laid, and the joints are so simple that they can be made up in record time. In addition to a brush and a bucket of soapy water, only one tool—a ratchet wrench—is required. Economy is the natural result.



THE wide range of sizes centrifugally cast by the American Cast Iron Pipe Company—from 2" through 48"—assures that American can furnish exactly the pipe and fittings your job requires. Each size is manufactured to the exact wall thickness required for specific operating conditions. Let American's long-experienced staff of skilled engineers, metallurgists, and craftsmen help you solve your next pipe installation problem. Write today for free booklet describing American Double-X Mechanical Joint Pipe.

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Trickling Filter Design Data

DESIGN DATA for trickling filters for secondary treatment of sewage are covered in some detail in the Manual of the Florida State Board of Health covering policies for design of sewer systems and treatment plants. Standard rate filters are described as those with applied BOD loading of less than 15 pounds per 1000 cu. ft. of media (about 650 lbs. per acre-foot) and hydraulic loadings not more than 4 mg. per acre per day. High rate filters are dosed at 10 to 30 mg. per acre per day with BOD loadings greater than 30 lbs. of BOD per 1000 cu. ft.

Media should pass a 3½-in. square screen and be retained on a 2-in. square screen. It should be clean, should be screened or forked at the plant site and should be placed in the filter by hand operated equipment or by a belt conveyor. Selected media should be placed by hand over the underdrains to a depth of 8-inches.

Underdrains with semi-circular inverts should cover the entire floor area. Inlet openings should equal at least 15 percent of the surface area of the filter. Slope of underdrains should be 1 percent. Provision for flushing underdrains is desirable. Sizes of drains and channels should be such that not more than 50 percent of the cross-sectional area will be submerged under design loading.

Filter Depth is recommended as not less than 4 ft. above underdrains nor more than 6 ft.

High rate filters, with recirculation, are approved where a final settled effluent of 30 ppm of 5-day BOD is acceptable. In such case, the applied load should not exceed 110 lbs. of BOD for 1000 cu. ft. of media (4790 lbs. per acre foot), per day, and the recirculation should be of such volume as to reduce the BOD of the sewage applied to the filter to not more than three times the strength of the desired settled effluent.

Roughing filters may be loaded in excess of 110 pounds of BOD per 1000 cu. ft. of media; and the reduction of BOD may be assumed as 63 percent if followed by settling. If not immediately settled, maximum removal is assumed at 50 percent.

Two-stage filters are acceptable for reducing the effluent below 30 ppm BOD. The BOD load applied to the second stage filter, including

Municipal Water Filter Installation cost can be cut 1/2 to 1/3 with...

SPARKLER *Diatomite* **FILTERS**

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL SCJ because:—

1. The original cost of a diatomite plant for public supply is ½ to ⅓ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces the chlorine demand of the water by removing organic matter to an exceptionally high degree. The overall bacteria reduction in the effluent is from 80% to 90%. Sterilization of the finished water can be accomplished with much less chlorine. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.

Less than 0.2% of water is required to sluice and clean the Model SCJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

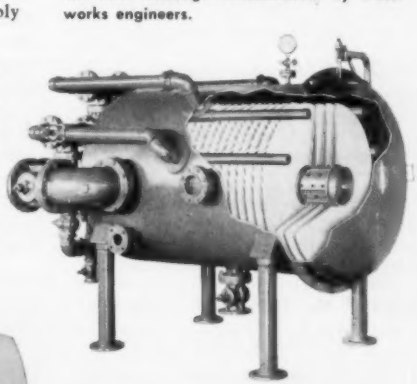
Operators can be easily trained to handle this filter, no highly skilled specialized personnel is required to insure efficient performance.

Sparkler Model SCJ filters can supply practically any required volume of city water. Single units with a capacity of 5,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.

Interior construction of Model SCJ Water Filter. Sparkler filtration engineers have introduced, in the SCJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced innovations in recent years.



SPARKLER FILTERS

SPARKLER MFG. CO., MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

FILTRATION ENGINEERING AND MANUFACTURING EXCLUSIVELY FOR OVER 35 YEARS.

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How 1 machine does work of 2

Suppose your city maintains 1 or 2 landfill garbage dumps. A front-end loader at each dump might cover about 100 tons of garbage daily. Neither rig is kept busy full-time, but it isn't worth the trouble and expense to load them on trailers and haul them around to do other jobs.

Then you get a D Tournapull. Just one. On a typical day your high-speed, rubber-tired "D" completes a schedule like this:

8:00 A.M. Operator reports for work, climbs on Tournapull and drives off. No waiting for flatbed, no loading or blocking. 28 m.p.h. rig averages 10 to 15 mph through traffic.

8:10 A.M. Arrives at city garbage dump 2 miles from garage. "D" uses its dozer blade to level refuse and its 7-yd. Carryall-Scraper to load, haul, and spread sand cover. Instead of *crawling*, it *runs* at its tasks . . . cleans up entire No. 1 Dump by 10:45 A.M. Drives to next job.

11:00 A.M. Rig reaches second dump, 3 miles away, gets right to work dozing garbage.

12:00 Noon. Lunch hour.

1:00 P.M. Continues hauling and spreading fill. Digs trench for future garbage burial and stockpiles earth for cover material.

2:35 P.M. Tournapull finishes at Dump No. 2, is ready to return to Dump No. 1, or handle odd-job assignment. Foreman sends Tournapull to grade small city-owned parking lot downtown.

2:50 P.M. Arrives at site after 2-mile drive. Removes dirt from parking lot and dumps it in old excavation a block away. "D" moves 70 cu. yds. hourly on 1600′ cycle . . . in 2 hours levels lot to hold 60 cars. Next time Tournapull has a few spare hours, it will be used to self-load, haul, and spread gravel on the lot.

4:50 P.M. Operator and rig take off for yard, drive a mile through rush-hour traffic in 5 minutes, are back at garage before 5 o'clock.

Impossible for 1 machine to do all this work in 8 hours? It happens every day in cities which own D Tournapulls. Dallas, Texas, for example, works *1* "D" at *5* widely-scattered garbage dumps.

When "D" is ahead on land-fill jobs, this multi-purpose machine can be kept busy on other assignments such as hauling fill to low spots in roadways, cutting drainage ditches, landscaping city parks, and many other assignments beneficial to the taxpayers. Machine travels anywhere in city within a half-hour — without special equipment to load and haul.

Ask your LeTourneau-Westinghouse Distributor for job-proved facts and figures on how American cities are getting better service with D Tournapull. He also will be glad to show you this handy rig in action.

Carryall, Tournapull—Trademark Reg. U.S. Pat. Off.
DP-343-P-ZZ-W

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Co.

recirculation, should not be more than twice as much as the BOD expected in the settled effluent. If there is no intermediate settling, first stage BOD reduction is assumed at 50 percent.

• • •

PUBLIC RELATIONS for Engineers

This is an abstract of a paper by Mark Watrous, Chief Engineer, Colorado Department of Highways, at the AASHO meeting.

THE FAILURE of engineers in public office—or in private business—to understand the fundamentals of public relations is notorious. By education and experience, we are engrossed in arriving at the precise answers that our profession demands. When we have come up with an exact result, we have been prone to assume that it, of itself, is sufficient: that explanations of how it was reached are of little or no consequence, and that its usefulness must be obvious to everyone.

Inasmuch as we are spending public funds, there is no question about our accountability. But many have pondered the questions: Where do we start a public relations program? How far should we go? Everyone accepts the fact we should set forth, with neat accuracy, a tabulation of receipts and expenditures —a requirement under the statutes which give us existence. But are we under compulsion to report, almost every hour of the day, on the plans we are formulating, the programs we are projecting for the future, the minor difficulties, the trivial triumphs—and even the personalities concerned in our far-flung, involved operations?

If we really intend to have a good public relations program, we see to it that everyone in the entire organization who possibly could be interested has access to complete information regarding the policy that has been set. And, if we believe there is the least chance that the public, also, would like to know, we make certain that it, too, is informed through established channels.

If we intended every right of way transaction to be an example of good public relations, we have instructed the appraisers, the negotiators and even the lawyers that all facts must be freely disclosed, from the nature of the contemplated improvement to the exact appraised valuation. We have insisted that fairness and patience must be the

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watchword in every step to negotiations, and we have allowed sufficient time to permit the transaction to be completed without pressure. It is possible to seize the old homestead and evict the grandchildren without making them long for the days when disputes over land were settled with six-guns.

Another problem of major importance is in the acquiring of access rights. As engineers, we know that the limited access highway is the safest facility we can build. We know it is vitally necessary for the reduction of accidents and the protection of the highway investment. We know that—but does the public? Do the individuals who live along the new freeway? Do the filling station operators and the proprietors of hot-dog stands who are going to be shoved back a few hundred feet and, consequently, put out of business?

The "by-pass" highway offers another headache of no small proportions. All of us have heard reverberations from this one—the clamor of irate citizens, excited city officials and usually calm people who have been aroused by a few individuals with strong vocal chords and special interests. This is one wild steer that we can't rope and hog-tie with a casual shoestring. The United States Chamber of Commerce set the pace in public relations on this issue several years ago when it conducted a "before and after" survey of by-passes, and published the findings in a most valuable booklet.

Everything the highway department does is "news." Even the hiring of new employees or the promotion of old ones is of interest in the home towns of those concerned. And, to those "home-towners," the employee in question is, many times, the Highway Department, the representative of the organization whom the folks meet on the street, in church or at social functions. His wife belongs to a bridge club or a reading circle, and his children are in contact with the youngsters of dozens of other citizens.

In theory, the highway department may be expected to have a good public relations representative in every person on its payroll. Every employee is a public relations representative—but is he a good one?

Every one of us practices public relations to some degree. It is the easiest thing in the world to make a small "show" of reporting to our millions of bosses, the citizens who pay us and provide us with funds for our work.

More work, in less time at low cost

Watch the smoothness of a modern Adams motor grader at work. See how easily it blades at any work speed. Take the wheel, drive it as you would your automobile... through city streets, to 25 mph... in reverse to 13 mph. Stand or sit at the controls, notice how clearly you see grade and load on the blade. With convenient power-controls you raise, lower, revolve or extend the blade to any desired position.

The heavy, box-construction, one-piece frame of this husky grader is built to resist shock and stresses. Weight is distributed to make use of full power in all gears. Big, powerful engine starts quickly in any temperature; has lugging ability to move heavy loads in tough going. Note how constant-mesh transmission gives smooth speed through all gears.

8 Forward Speeds — to 25 mph

A speed for every grading operation. You get work done fast, save time moving job-to-job. Three additional "creeper speeds" (.23 to 1.82 mph) are optional. They make it easy to rip hard-packed roads and old asphalt, root out unseen roots and stones without severe shocks, make for accurate finishing in tight places. *No other grader offers this wide range of operating speeds.*

Rugged scarifier (optional) rips up gravel, crushed stone, blacktop, sheet asphalt road and street surfaces. Has replaceable points.

4 Reverse Speeds — to 13 mph

Wide range of reverse speeds saves time on shuttle-grading and mixing, backing to buck snow drifts, etc.

Double-action Hydraulic Brakes. Service brake applies braking action to transmission as well as wheels; surer, safer stops, with less pedal effort.

Rubber-Mounted Engine. Vibration is not transmitted through floor to machine and operator. Means less maintenance, better efficiency.

See ADAMS before you buy

Select your next motor grader on the basis of *performance*. Ask your LeTourneau-Westinghouse Distributor for performance facts and specifications. Learn why Adams graders do *more* work, in *less* time, at *lower* cost.

A size ADAMS for every need

Model 220— 60 hp diesel engine, 14,865 lbs.
Model 330— 80 hp diesel engine, 20,500 lbs.
Model 440—104 hp diesel engine, 21,500 lbs.
Model 550—123 hp diesel engine, 23,500 lbs.
Model 660—150 hp diesel engine, 27,730 lbs.

TraveLoader — A high-speed, heavy-duty, self-propelled, belt-type loader for picking up materials and loading into trucks from windrows or stockpiles. Your choice of 55 hp gasoline or 60 hp diesel, 16,800 lbs.

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LeTourneau-WESTINGHOUSE Company

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PUBLIC WORKS DIGESTS

THE WATER WORKS DIGEST

Modernizing Filter Plants

Compared to other features of a modern water treatment plant, the filters often add the least to water quality but usually cost the most. The author believes that their cost can be lowered and suggests methods for doing so. Pretreatment of water has been dependably and markedly improved, and therefore the filtering rate can be increased from 2 to 4 or 5 gpm per sq. ft. Therefore the filter area can be decreased. Also the size of individual beds can be increased in many cases, not overlooking the necessity of withdrawing one at a time for washing. Another economy may be elimination of elevated wash water tanks. Others suggested are elimination of rate-of-flow controllers. Also the cost of housing the filters in an ornamental building seems to be unnecessarily high in many cases. The possibility of using local sands instead of more expensive imported ones should be investigated.

"Unique Features in Filter Plant Design." By H. O. Hartung, Production Supt., St. Louis County Water Co. *Jour., A. W. W. Ass'n*, February.

New Water Plant of Miami, Fla.

Miami's Alexander Orr, Jr., treatment plant was designed for 40 mgd present capacity, with provision for increase to 100 mgd. The water supply is drawn from wells located in the Everglades four miles west of the treatment plant, to minimize the possibility of salt water infiltration. This water has a color of 10.0; 0.7 ppm of iron; 81 ppm calcium; total hardness 213.0; fluorides 0.2 ppm. The total hardness of the plant effluent is between 70 and 80; the color is reduced to 3.0; the iron to a trace. The fluorides are increased to 0.7 in summer and 0.9 in winter. The well water passes first through 4 upflow clarifiers for lime softening; then to the recarbonation basin. The effluent from this is chlorinated and sodium silicofluoride added. It is then filtered. There is a reserve well field of 7 wells near the plant site which can be drawn upon in case of power failure at the main wells or to reduce the "on-peak demand" during the high consumption of winter. Sludge from the softeners is discharged into a 15-acre lagoon. For recarbonation, scrubbed diesel exhaust gas is used containing about 5.5% carbon dioxide. Filtered water is stored in a well beneath the filters and in a 4 mg reservoir one-third underground. The treatment plant cost $3,491,010; the entire well system and supply main cost $1,288,-130.

"Miami's Newest Water Plant." By D. B. Preston, San. Eng. and R. J. Brehm, Supt. *Water & Sewage Works*, March.

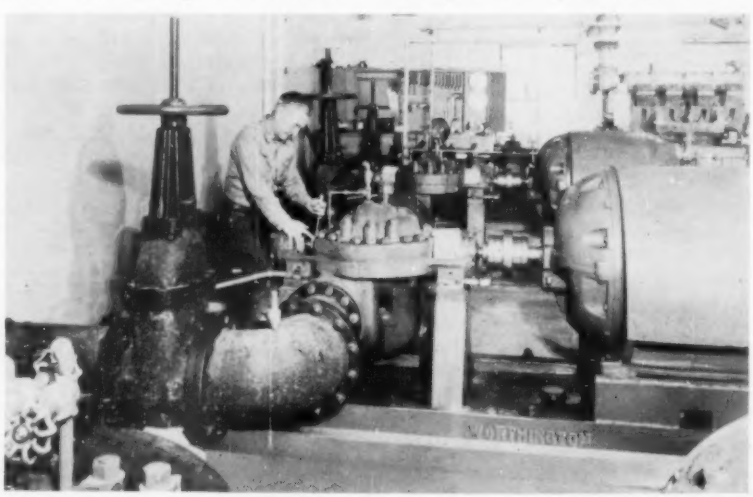
Coating and Wrapping Steel Pipe

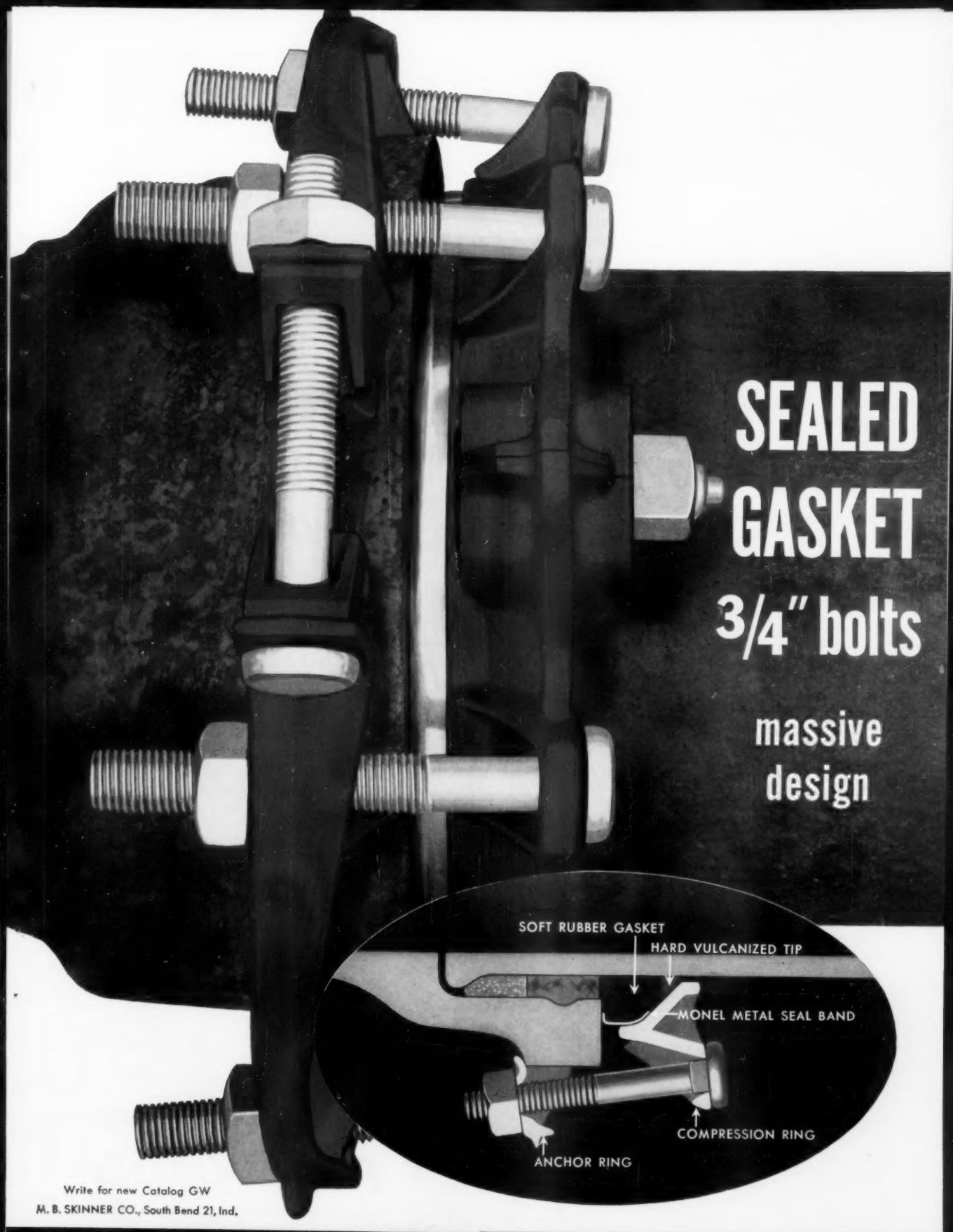
The Bureau of Reclamation has for several years been conducting

Colorado Springs Has Three-Part Water Supply

SIX 400 hp centrifugal pumps push water through 92,810 feet of pipeline with a lift of 1,580 feet to deliver 6 million gallons of water per day to the City of Colorado Springs, Colorado. Three of the pumps are located at the Lake George Pumping Station and three are at a secondary pumping station. The pumps are each rated at 2 MGD capacity, and each station is equipped with a 200 hp gasoline-engine-driven pump for standby service. The secondary pumping station is 780 feet higher in elevation than the Lake George Station.

Water is also supplied to Colorado Springs by the Fountain Creek Valley station, where water is pumped to a common sump by means of four 30 hp pumps. It is then carried from the sump to the distribution system by three 300 hp units. These seven pumps are all of the vertical turbine design. All 15 pumps in the three-part supply system are Worthington units. The population served by the Water Department in Colorado Springs has increased from 40,000 to 60,000 in the past ten years.





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SKINNER-SEAL BELL JOINT CLAMP

laboratory and field tests of protective coatings for steel pipes. About twenty different coatings, most of them proprietary products are being tested, and reports are made at intervals of the conditions of the test pipes. All specimens were first cleaned, preferably by sand-blasting. So far, no paint system has been found that will perform as effectively over a rusted surface as it will over a well cleaned surface. *Coal-tar enamel* has shown itself to be an excellent product for lining steel water pipe except where the lining will be exposed to temperatures of less than —20° F. It is also well suited for the exterior of buried steel pipe providing the coating is adequately reinforced or shielded against soil stress. *Cement mortar* is effective providing it will not be exposed to extended drying periods. It also is an excellent exterior coating that is unaffected by soil stress. Properly formulated *vinyl resin* and *phenolic resin* paints provide serviceable linings; are not adversely affected by either low atmospheric temperatures or drying out periods. Phenolic vehicles are also well suited for priming paint and aluminum finish paint for the exterior of exposed steel pipe. *Glass mat* and *asbestos felt* are effective wrapping materials for coal-tar enamel coatings; asbestos felt is preferred where clay soils are used for backfill. Vinyl and polyethylene plastic *tapes* apparently provide effective exterior protection for straight pipe and welded joints. Glass-reinforced coal-tar tape provides effective protection that can be molded around fittings and irregularities. Brushed neoprene coatings are well suited to lining pipe; and zinc pigment, inorganic vehicle coatings, and epoxy resins show promise.

"New Developments in Tests of Coatings and Wrappings." By Graydon E. Burnett and Paul W. Lewis, of the Bureau of Reclamation." *Jour., A.W.W. Ass'n*, February.

Electrical Inspection Of Steel Pipe Coatings

The author describes the methods and equipment used for making tests for holidays in coal-tar enamel coatings. Paints do not have sufficient dielectric strength and film thickness to permit electrical inspection. The method cannot be used for determining thickness, as a good coating may be seriously damaged by a voltage sufficient for this purpose. Electrical inspection of coatings may be performed after the pipe has been backfilled and put into service by means of special equipment described by the author.

"Electrical Inspection of Steel Pipe Coatings." By S. Mark Davidson, of Thompson Pipe and Steel Co. *Jour., A.W.W. Ass'n*, February.

Designing Cement-Coated Pipe

The author considers that cement coating furnishes the best practical protection for steel pipe that is available today. This coating should be considered in calculating the thickness of steel to be used, and methods of doing this are discussed. It is concluded that this thickness should be computed by the Barlow formula, using a steel stress of 13,500 psi. The mortar lining is assumed to be ½ in. thick, and the coating ¾ in. thick reinforced with 2-in. by 4-in. wire mesh, according to AWWA Standard Specifications C-205.

"Design of Steel Pipe With Cement Coating and Lining." By E. Shaw Cole, Chief Eng. of Pitometer Associates. *Jour., A.W.W. Ass'n*, February.

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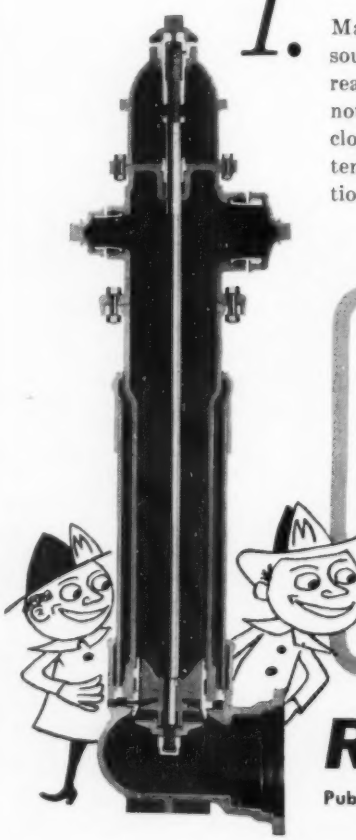
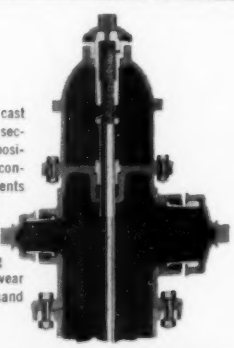
You need ask two questions

1. **Will they be ready for instant use in an emergency?**

Mathews Hydrants are so simply and soundly constructed that they are always ready. Water, ice and sandy deposits cannot reach key parts to rust or freeze, or clog operation. In any weather and all temperatures, Mathews Hydrants function with a minimum of maintenance.





Stuffing box plate, cast integral with nozzle section, provides a positively leakproof construction. It prevents any water or sand from reaching the operating thread. No rusting, freezing or clogging. No wear on thread through sand abrasion.

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Experiences With Activated Silica

Charlottesville, Va., obtains its water supply from small mountain streams. The hardness is 6 to 18 ppm, solids 30 to 50 ppm, color 5 to 200, turbidity 5 to 100 ppm. Prior to 1950, untreated raw water was applied directly to aerators and slow sand filters. The filters clogged so severely it was impossible to keep them clean. After 1950 the water was coagulated with alum but very poor floc was obtained, until sodium silicate was added, when a very dense floc was produced. A silica dosage of 2 to 3 ppm gives best results. In 1953 a "Silactor" for activating silica with chlorine was purchased. In 1955 five 1 mgd rapid sand filters were put into operation. Since then the slow sand filters have been operated at a very low rate to keep them from turning septic, and are used only when the demand exceeds the capacity of the rapid sand filters. Experience here has shown it to be next to impossible to coagulate this water without activated silica.

"Experience with Activated Silica at Charlottesville, Virginia." By C. G. Haney, Supt. of Filtration. *Water & Sewage Works*, March.

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about fire hydrants:

2. Can the hydrant be quickly replaced if broken in a traffic accident?

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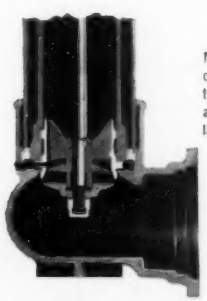

Main valve, true compression type, opens against and closes with water pressure. The higher the pressure, the tighter the valve. When hydrant is broken in traffic accident, there's no leakage with consequent dangerous loss of pressure.

Available for mechanical joint connections

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Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

Electrical Reliability In Water Plants

The author discusses the more serious power interruptions by which all process machinery is affected. One valuable planning step is analysis of plant functions to establish allowable power-outage times for each plant process; from which, the corresponding times for the electrical loads associated with each process can be determined. The process outage tolerances can be used in negotiations with the company furnishing power to the plant, as well as in planning the plant power distribution system, particularly in selecting between straight radial distribution and other forms. Contributing to final reliable performance are selection of high-quality equipment, correct installation by experienced contractors, and careful maintenance at regular intervals by the operating personnel.

"Electrical Reliability in Water Plants." By E. O. Potthoff and N. L. Hadley, of General Electric Co. *Jour., A.W.W. Ass'n*, February.

Leaks in Service Lines

Statements from 26 waterworks officials who were asked how they located such leaks gave the following methods as being used by them: Listening to bar contacting the pipe, 9; electronic leak detector, 7; Aquaphone, 7; Geophone, 12; Sonoscope, 4; M-Scope, 7; meter readers report leaks, 24.

"Leaks on Service Lines." *Water Works Engineering*, March.

Suitability Of Plastic Pipe

During the past three or four years studies have been carried on at the University of Michigan to determine the suitability of 22 plastics for use as underground water pipes with special regard to freedom from toxicity and from deleterious effects on the water. The study included 8 samples of polyethylene; 8 rubber-modified polystyrene, 5 polyvinyl chloride (including Saran), and 3 cellulose acetate butyrate; and others not recommended for water supply.

This study has shown that plastic pipe of certain types including those commonly recommended by the manufacturers for water supply use when properly installed does not introduce toxic substances; affect

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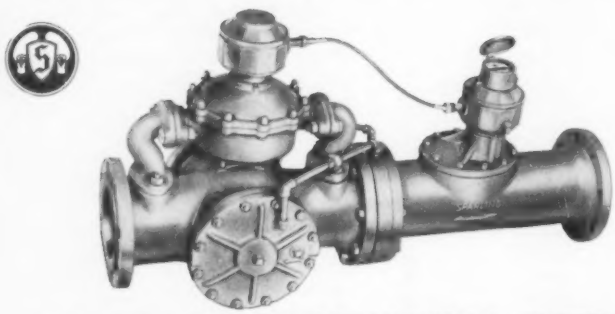

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color, flavor, or odor of the water; nor interfere with maintaining chlorine residuals in such water, nor in the disinfection of new pipe lines by the standardized procedure. A plan has been developed and now is in effect for placing a controlled hallmark on plastic pipe which on test has been found to be suitable for use with potable water supplies thus giving the engineer a practical basis for identifying and specifying plastic pipe suitable for this use. Other criteria must be used to select pipe for its physical characteristics.

"Plastics in Water Supply." By Walter D. Tiedeman, Director, Nat'l Sanitation Foundation Testing Laboratory. PUBLIC WORKS, April.

"Specific Capacity" Of Water Wells

Contrary to popular conception, the "specific capacity" of a well is not a constant, but decreases as the well continues to be pumped at a constant rate. The author explains this, showing that the term can properly be used only when comparing two wells which obtain water from aquifers with similar boundary conditions. The pumping rates and the pumping periods at which the "specific capacities" were obtained should be given consideration.

"Specific Capacity as Applied to Water Wells." By Jack Bruin, Univ. of Illinois. *Water Works Engineering*, March.

Other Articles

"Our Fast Growing **Water Needs** Broadly Affect Planning." By Harry E. Jordan, Sec'y A.W.W. Ass'n. Water Works Engineering, March.

"**Water Filtration** Methods and Results." Part 5 of an Operator's Manual on Laboratory Control. By F. W. Gilcreas, Prof. of San. Science, Univ. of Fla. Water Works Engineering, March.

"Quaint **Caracas Goes Modern**—Water System Follows Suit." By D. M. Carew. Water Works Engineering, March.

"Instrumentation and **Automatic Control** of Booster Pumping Plant at the Hawkesworth Works of the Yeadon Waterworks Company." Details of fully automatic duplicate plant in England maintaining constant head. Water & Water Engineering, February.

"The **Small Water Utility's** Responsibility to the Consumer." By A. E. Clark, Mgr. Nashville Suburban Utility Dist. Water & Sewage Works, March.

"**Control of Corrosion** with Lime. Review of Basic Principles." By Edward S. Hopkins. Water & Sewage Works, March.

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All water meters are fine instruments. Any fine instrument loses accuracy as it wears. Because of this fact, written between the lines of any water meter price are two items you can't read for many years. Yet they are vital in choosing the lowest "total price."

First, as a meter loses accuracy, it gives away revenue. Before its first overhaul it may give away twice as much money as it seems to save in its "low bid" original price.

Secondly, to keep the meter accurate you may have higher repair costs over the years . . . or premature scrap-and-replace costs. Good meters often vary widely in this respect.

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"**Filtration.**" Part of a series on Water Works Practices. By George E. Symons. Water & Sewage Works, March.

"32-Mile Pipeline for **Cape Town's** New Water Treatment Project." By George Aschman. Water & Sewage Works, March.

"Selecting Adequate **Electrical Switching** Equipment." By Joel P. Kesler. Jour., A.W.W., Ass'n, February.

"**Watershed Control** in Maryland." By L. G. Ningard, Supt. of Watersheds, Baltimore. Jour. A.W.W. Ass'n, February.

"Water Service Policies for **Suburban Areas.**" By C. K. Mathews. Jour., A.W.W. Ass'n, February.

"Distribution to **Suburban Vancouver** Areas." By T. V. Berry, Com'r, Greater Vancouver Water Dist. Jour., A.W.W. Ass'n, February.

"Realistic Limitations of Flow Measurement **Rangeability and Tolerance.**" Definitions of these terms and methods of extending rangeability. By L. K. Spink and R. C. Tamm. Public Works, April.

"**Valdese Water Plant** is in Keeping with Modern Industry." By Lee Ribet, City Mgr., and W. K. Dickson. Public Works, April.

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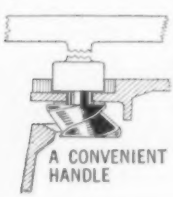
Snow, ice and dirt tending to hold down meter box lids are easily conquered with the Ford Lifter Worm Lock.

This simple mechanism, operating like an auto-jack, has a tremendous lifting force that breaks any seal around the edges of your covers.

It's handy, too, because it locks and unlocks your lid to prevent tampering. It offers extra safety because an unlocked lid is detected at a glance.



The key which operates the Lifter Worm Lock serves as a handle to lift the lid, saving time and keeping hands clean.

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"This **Diffusion Well** Won't Flood" when returning cooling water to ground water only 11 ft. below the surface. By John F. Hoffman, of New York Telephone Co. Engineering News-Record, March 8.

Erie County, N. Y. "Water Authority Adds Filter Capacity to Meet Growing Demands." By Harry Huy, Exec. Eng., and Newell L. Nussbaumer. Water Works Engineering, March.

• • •

Developments in Radioactive Waste Disposal

SANITARY ENGINEERING aspects of the disposal of radioactive waste materials are reported under the heading "General Engineering and Developments" in the Nineteenth Semiannual Report of the Atomic Energy Commission, dated January, 1956. The following paragraphs are quoted from this publication:

Major emphasis continued to be placed on the solution of problems arising from the handling and disposing of high level radioactive wastes. Chemical plants which process irradiated fuel elements are the chief source of these wastes.

At the Brookhaven National Laboratory, the pilot plant for the fixation of radioactivity on montmorillonite clay continued "hot" operation to provide data for possible application to full-scale plants. Application of this technique to various types of wastes from fuel processing is being studied. At the Johns Hopkins University, investigations were started on the fixation of fission product wastes on hydrated aluminosilicates.

The Oak Ridge National Laboratory worked on the fixing of radioactivity in mixtures of natural earth materials such as limestone, shale and sodium carbonate. The use of radioactive decay heat in accomplishing this fixation is also under investigation. Fixation studies were also carried out at the Los Alamos Scientific Laboratory, Argonne National Laboratory. and at the chemical processing plant at the National Reactor Testing Station.

The possibilities of ocean disposal were considered by a meeting of advisory oceanographic experts at the Woods Hole Oceanographic Institute. This conference resulted in the conclusion that a number of oceanographic questions must be answered before the feasibility of such disposal can be assessed.

A conference of geologists, petroleum engineers, and other geophysical experts at Princeton University considered for the Commission the

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possibilities of underground disposal. They concluded that such direct disposal may be technically feasible in deep basin formations containing stagnant brines, in spaces formed by dissolution in salt beds or salt domes, in excavations in impermeable shales and, under certain conditions, in unsaturated zones at considerable distances above the water table. However, much development work is required before this kind of disposal can be put on a practical, continuously operating basis.

Disposing of wastes by pumping them into wells drilled for the purpose was investigated at the University of California. Major effort on this project was directed to study of the reaction between radioactive materials and standard earth materials.

Oak Ridge National Laboratory continued its investigation of the use of surface pits excavated in the Conesauga shale formation for direct disposal of high level radioactive wastes to the earth.

Evaluation of the dilution factors in streams with respect to low level wastes was continued by Harvard University and the Technological Institute of Northwestern University. At Massachusetts Institute of Technology, fall-out data collected during the 1955 weapons test at the Nevada Test Site in 25 water supply systems throughout the country were compiled and interpretation was begun. It was apparent that nowhere did radioactivity concentrations reach levels which would create a public health problem.

At the U. S. Bureau of Mines, design work progressed on incinerators for disposing of 30 and 100 pounds per hour of combustible wastes contaminated with low-level radioactivity. The design was started by the Harvard Air Cleaning Laboratory.

Two major conferences attended primarily by AEC and contractor personnel were held—the Fourth Annual AEC Air Cleaning Conference at Argonne National Laboratory and the Third Sanitary Engineering Conference at the Robert A. Taft Sanitary Engineering Center of the U. S. Public Health Service, Cincinnati. The latter meeting, sponsored jointly with the U. S. Public Health Service, also was attended by state public health representatives.

• • •

Vehicle Cost Accounting System

COST ACCOUNTING has been extended to the municipal vehicle fleet at Meridian, Mississippi. The total repair and operational cost of any piece of motor equipment can be determined at any period. All purchases made by the municipal garage are first charged to the municipal supply room, a working capital fund; then charged directly to the vehicle.

In order that the total cost record may be complete, a numbered order sheet in duplicate, 8½ x 11, is made each time any vehicle is serviced or repaired, even for gasoline, oil or lubrication. All charges are broken down into the following main subsidiary accounts: fuel; oil; lubrication and service; tires and tubes; outside repairs, repair parts and labor; and, of course, total net cost. The original is filed at the municipal garage by vehicle number and the duplicate is forwarded to the central bookkeeper for accounting entry. Each order is then recorded on an individual charge sheet for each vehicle for the month. On the 20th of each month totals are recorded for a requisition and transferred also to an individual equipment record. This form includes insurance, depreciation and overhead, giving a total operating cost during the year

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20 feet LONG

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The MODERN 20-foot lengths make it easier and faster to lay, saves you money in construction costs. Available un-coated, tar coated or cement lined, also bell-and-spigot. IMMEDIATE SHIPMENT. Write or telephone nearest McWane sales office.

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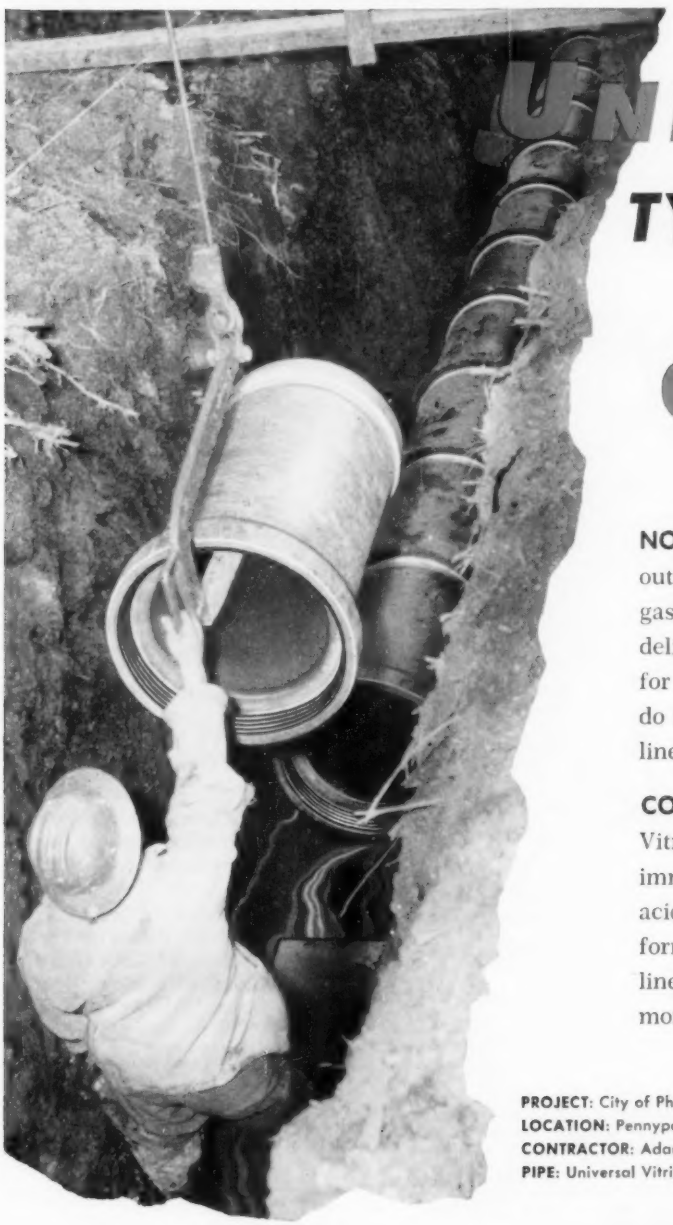

NO PIPE-LAYING DELAYS either in or out of the trench. Pipe and TYLOX flexible gasket are assembled at the factory and delivered promptly to the job site, ready for immediate installation. Wet trenches do not slow up the work. Finished line can be backfilled immediately.

CORROSION-RESISTANT Universal Vitrified, Tylox-Jointed Clay Pipe is immune to sewerage and industrial waste acids and alkalies. Together they form a leak-proof, corrosion-resistant line *throughout*. Write today for more information.

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or any month during the fiscal period.

Vehicle cost per mile, miles per gallon of gasoline, hours run, and cost per hour are information details which can be interpreted at any time necessary from this individual equipment record. After six months' trial the garage superintendent, department head and the city manager are convinced that such record keeping saves time and definitely determines overall vehicle unit cost.

This procedure already has convinced Meridian city officials what type of police vehicles it should purchase and how long to keep them, and further, it has retired several other types of "old" vehicles which could be replaced by newer ones at an overall reduction in unit cost.

This information was furnished by Jack Tallent, City Manager, Meridian, Mississippi.

• • •

Yes, People are Funny

The following is from the annual report of Ed. F. Muckleroy, Supt., Department of Sanitation, El Paso, Tex. The heading above is his as is the wording that follows.

Twelve pocket books were recovered by our hand sweepers in the up-town district; all had Army I-D cards; none had a cent in them; all owners were located by the Dispatcher.

Nine sets of Citizenship papers were found in the gutters of the City and we located all the owners.

Called the Military Police 8 times during the year to turn over wallets and Service Men's I-D cards.

One wrist-watch, a good one, found in a garbage can and returned to a grateful housewife; bet her husband never knew his watch was lost.

One pretty red Suitcase had several checks that had been endorsed, about 200 bucks worth; returned to a thankful lady.

Inspector Beard and Scotten returned 9 dog collars and 12 sets of shoulder harness to owners whose dog pets had met traffic head on.

One Man's wallet with $1,200 of checks, over $600 endorsed and ready to cash; returned before the owner missed the wallet.

One hand sweeper found 126 letters, all stamped and ready for mailing, and posted them to the care of Uncle.

• • •

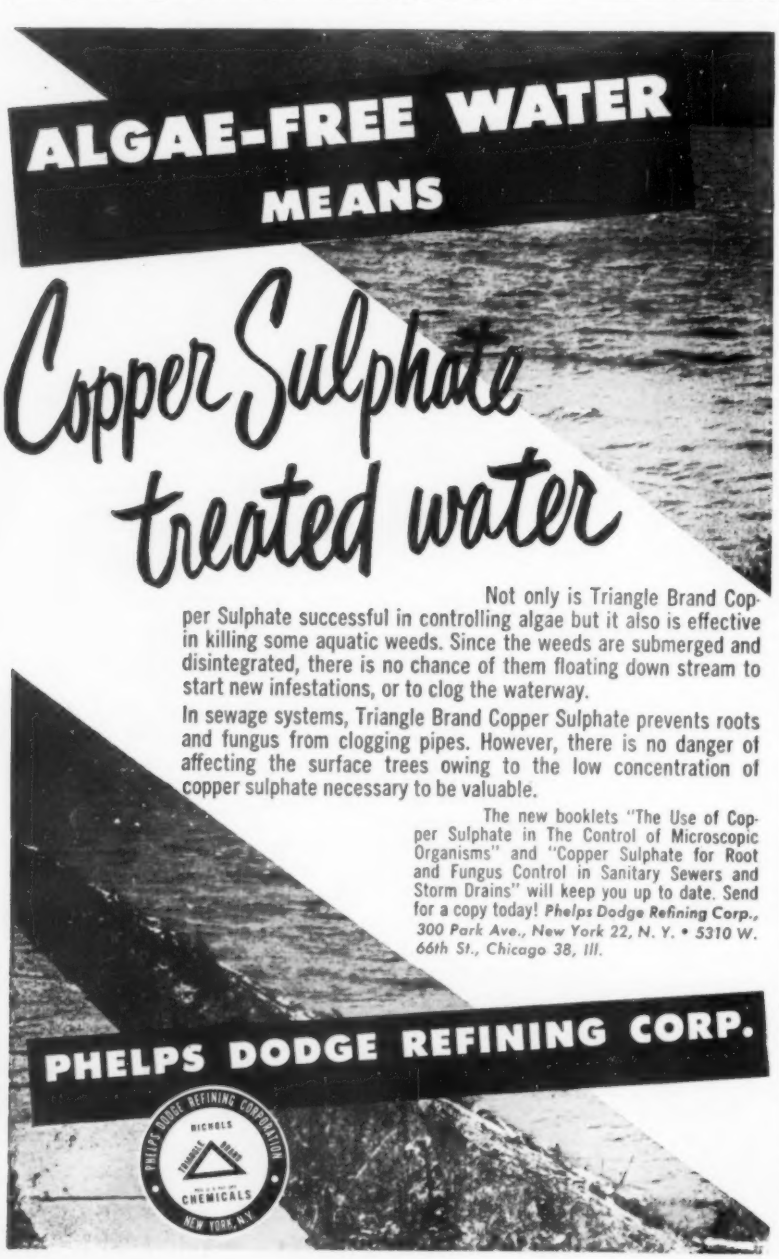
One Phase of Public Relations in Oak Park

In the equipment of its service units such as sewer maintenance or tree trimming gangs, Oak Park, Ill., includes supplies of leaflets to be distributed to the homes in the neighborhood where the crews are working. While these crews are working one member deposits in residence mail boxes leaflets describing the operation, the source of funds and the needed co-operation of the public.

• • •

Graduate Study in Sanitary Engineering

Programs of graduate study in Sanitary Engineering have been announced by the Department of Civil Engineering, University of Florida. Fields of water supply and wastes engineering, sanitary engineering design, environmental sanitation, air pollution and radiological health will be given leading to degrees of Master of Science of Engineering and Doctor of Philosophy in Sanitary Engineering. For further information write to the Dean, Graduate School, University of Florida, Gainesville, Fla.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treated water
Not only is Triangle Brand Copper Sulphate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulphate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulphate necessary to be valuable.
The new booklets "The Use of Copper Sulphate in The Control of Microscopic Organisms" and "Copper Sulphate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y. • 5310 W. 66th St., Chicago 38, Ill.
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GET FAST DELIVERY ON *MANY* CHLORINE PRODUCTS IN WHATEVER CONTAINER BEST FITS YOUR NEEDS

Stop the cost and nuisance of storing huge amounts of Chlorine. Buy only what you need—whether it's several carloads, just part of one tank car, or as little as 16 lbs.!

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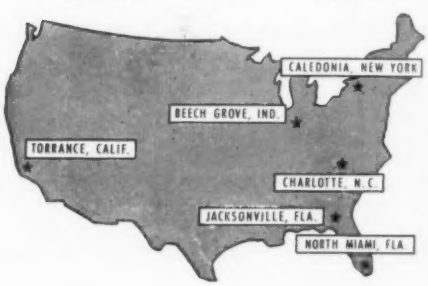

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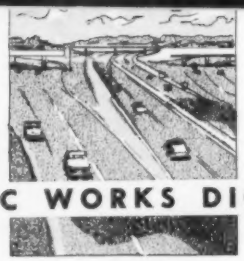


PUBLIC WORKS DIGESTS

THF HIGHWAY AND AIRPORT DIGEST

Cementing Traffic Bars to Pavements

The California Highway Department, wishing to eliminate the steel dowels used for fastening concrete bars to road surfaces, has developed an epoxy-thiokol adhesive which retains the bars in place in spite of severe abrasion and impact of traffic. Experience with the cement has been confined to concrete pavements but it is believed that it will be equally successful on asphalt plant-mixed surfaces. This new adhesive is more expensive than the asphalt emulsion previously used, but a smaller amount is needed and its greater permanence seems to make it more desirable.

"Traffic Bar Durable Installation." By Herbert A. Rooney and James A. Cechetini, Testing Engrs. *California Highways*, February.

Slurry for Sealing Cracks in Asphalt Surfaces

Inglewood, Calif., seals cracks in a deteriorating asphalt surface by use of a slurry squeegeed onto the pavement. The slurry consists of a mixture of 700 lb. of rock dust and 15 gal. of SS-2 emulsified asphalt, with 10 gal. of water. The dust has a sieve analysis of 90-100 percent passing a No. 20 sieve; 85-95 percent a No. 30 sieve, and less than 10 percent a No. 200. This is mixed in a plaster mixer and discharged onto the pavement, which has just been wet; then squeegeed over the surface, filling cracks and minor depressions. The cost is less than ½ cent per square foot.

"Save the Street With Slurry." By W. E. Peebles, Dir. of Public Works, *American City*, March.

In-Service Training By Florida Highway Department

An in-service training program established by the Florida Highway Dept. in 1953 has proved to be a good morale factor in the entire engineering organization and is considered to be a great success. It is attractive for young engineers just finishing college, has helped the department meet the competition of industry in getting new employees, and has been an incentive for the experienced employees to qualify for positions of greater responsibility. Of the trainees, 42 have been college graduates in civil engineering and 52 have been graduates from other college courses. A trainee is a regular working employee who is moved progressively through the following courses: administration; highway location and design; bridge design; highway and bridge construction; materials testing; and highway maintenance. When he has completed each course satisfactorily, a trainee's salary is increased $10 to $20 a month, progressing from an entrance salary of $350 a month to $450 when the program has been completed.

"In-Service Training Program for State Road Department." By T. L. Bransford, Eng. of Research and In-Service Training. PUBLIC WORKS, April.

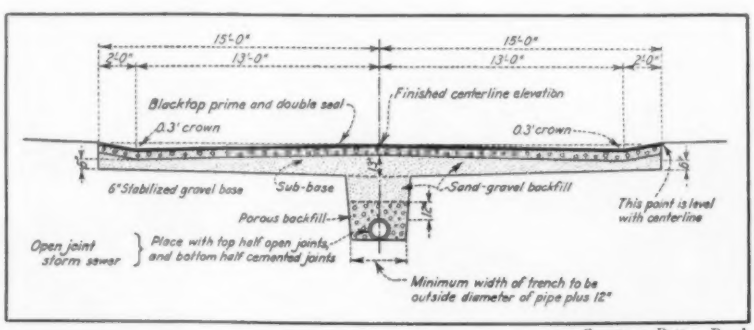
Training Equipment Operators

Operators of machines used in highway work must be trained to operate them not only skillfully but also with safety to protect road workers from traffic and traffic from road equipment. Many highway officials rely on experienced operators to train new men in the care and operation of machines; or the manufacturers will furnish instruction when a new type of machine is purchased. In many departments meetings are held periodically at which employees discuss mutual problems and hear safety talks. Occasionally a department's insurance carrier will furnish safety films to be shown to the men.

"Training Road-Equipment Operators." Information furnished by officials of a dozen state and county highway departments. *Better Roads*, March.

Contracting Highway Maintenance

The Minnesota department of highways maintains 11,800 miles of state trunk highways at an annual expenditure of $15,000,000. About 27 percent of this is paid for contract work. It would be impossible or very difficult to let to contract many of the types of maintenance because of the large number of variables. One organization takes care of routine work and emergency repair work but other specialty jobs can be performed more efficiently and economically by contract. Also during seasons of peak loads of work the state organization is not sufficiently large to handle it all. Especially adapted to contract performance are bituminous surface treatments, repairs and seal coats; production of mineral aggregates; regraveling; installing culverts; sodding; weed



Courtesy Better Roads

● **STANDARD 30-ft. black-top valley gutter section, Kent Co., Mich.** **See p. 188.**

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Its reliable 75 HP Caterpillar Engine delivers efficient power from low-cost non-premium fuels.

Operators like its sure, positive mechanical controls; its unmatched visibility; its fast, accurate blade positioning; its accelerator-decelerator that lets you override the hand throttle for better maneuverability with considerably less clutch wear.

For spring clean-ups, for year-around duty, the No. 112 is an ideal public servant. Let your Caterpillar Dealer demonstrate why.

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spraying; cleaning and sealing joints in concrete pavements; guard rail installation, and stockpiling. During 1955, 41 contracts were let to 28 different contractors, for which work 183 bids were received. These contracts totaled $1,727,100. About the same amount was spent for renting equipment, such as air compressors, bituminous distributors, pavers, power brooms, tank trucks, cranes, draglines, tractors, graders, mowers, plows, scrapers and trucks.

In awarding contract work, it is emphasized that the contractors understand that maintenance work is usually critical in nature and rapid performance and early completion are essential.

"How We Use Contractors and Their Equipment in Highway Maintenance." By G. A. Meskal, Maint. Eng. *Roads and Streets*, March.

A New Soil Stabilizer

A new soil stabilizing chemical is being tested by the Indiana Highway Commission on two highways. One subgrade has a high clay content and the chemical is mixed to a depth of 6 in. At the other site the soil is predominantly silt with a low degree of cohesion, and here the chemical is mixed to a depth of 6 in. for a length of 250 ft. and to a depth of 3 in. in another strip. The material, called "Arquad 2 HT," is expected materially to improve the wetting properties of the compaction water, virtually destroy the capillarity of the soil and increase its compressive strength.

"New Chemical Tested as Soil Stabilizer." *Roads and Streets*, March.

Electronic Computers For Highway Departments

Manufacturers of electronic computers furnish equipment useful in several kinds of calculation by highway departments. It is claimed that in cut and fill computations, one operator with an electronic computer can do the work of 15 mathematicians with mechanical desk calculators. By feeding the engineering survey data of the cross-sections of both the original surface and the finished roadway into a machine, it can compute the volume of cut and fill, summarizing the volume as it goes along, at rates as high as five cross-sections a minute. One such machine costs about $39,000, or rents for about $1,000 a month.

"Electronics: A New Tool for Engineers." *Engineering News-Record*, March 15.

Street Requirements For Subdivisions

In Kent County, Michigan, all plats for residential developments outside incorporated cities and villages must be approved by the county road commission. By November, 1955, the county had approved 99 plats in the county outside of Grand Rapids, totaling 20 miles of streets. At first, building was encouraged by permitting low-type gravel streets, 30 ft. wide with a 6-in. crown. No side ditches were required in sandy, gravelly areas, where drainage was by seepage and leaching basins. In heavy soils they required 24-ft. width and ditches 18 in. deep below the shoulder with a 2-ft. flat bottom. These deep ditches were objectionable to abutting property owners, in some cases open-joint pipes were laid in them and the ditches filled. These streets were not paved, and the gravel surface was unsatisfactory and expensive to maintain. The requirements now are for a black-top prime and double seal surface on 6 in. of compacted gravel. The subgrade slopes toward the center, where an open-joint storm sewer is

City of Winston-Salem (N.C.) sweeps downtown walks with their Tennant "75" Sweeper.

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The slurry, itself, consists of a mixture of Bitumuls emulsified asphalt and water to which sand or crusher dust (or a combination of both) is added to form a free flowing mix.

Typical Slurry Preparation

On a typical successful operation, the Bitumuls emulsion and water were first fed into the drum of a transit mix truck. Then aggregate, conforming to the following gradation, was added slowly to assure complete coating:

Sieve Sizes	*Per cent Passing*
Number 20	100
" 30	91
" 50	54
" 100	20
" 200	5

Method Of Application

The slurry, delivered to the job in the transit mixer, was chuted into a spreader box, towed behind the mixer truck, onto the pre-watered pavement. (The spreader box was a rectangular, sled-like frame, one traffic lane in width. It was equipped with a rubber strike off, or squeegee blade, which assured even distribution and uniform coating, and forced the slurry into cracks and depressions.)

Pioneered In The West

Quickly and easily applied at exceptionally low costs, Bitumuls slurry sets rapidly and can usually be opened to traffic within two to three hours.

This method was pioneered by Los Angeles County forces. Working closely with them were Engineers of American Bitumuls & Asphalt Company.

Bitumuls Slurry Seal has been used effectively in both Southern and Northern California, and test sections have been placed in other areas of the country. The "big news" of this relatively new method of extending pavement surface life is spreading fast. Get full data from our nearest office.

Aggregate and Bitumuls are fed into transit mix truck, then water is added as required.

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placed, usually 5 ft. below the finished surface. Open ditches are not allowed. In good draining soils the open-joint is omitted; drainage is by leaching basins at approximately 300-ft. intervals, connected to each other across the road but not longitudinally; and at low points in the street grades a run of leaching sewer is placed; about 25 ft. of road length for each acre of drainage.

"Reconstructing Platted Streets in Subdivisions." By Martin DeRuiter, Asst. Co. Eng. *Better Roads*, March.

Other Articles

"Looking Ahead Brings New Highway **Shop Building** for Douglas Co., Wis. Highway Dept. Paid for by laying aside $50,000 each year from the annual levies. By E. M. Potter, Highway Com'r. Public Works, April.

"**Arizona Safety Program** Reduces Highway Worker Accident Rate." By Dean Smith. Public Works, April.

"Road Surfaces." Tests on **slipperiness** of road surfaces in England. By J. H. H. Wilkes, County Surveyor of Somerset. Contractors Record, Feb. 8.

"**Salary Scales** for Highway Engineers" in five states. Public Works, April.

"**Right-of-Way** Practices in Minnesota." By E. S. Ward, Kankiyohi Co. Eng. Public Works, April.

"**Records** for County Bridges and Culverts." By Wesley D. Smith, Asst. Eng., Hamilton Co., Iowa. Public Works, April.

"**Technical Manpower** Supply for Secondary-Road Program." By John E. Stoner, Prof. of Govt., Indiana Univ. Better Roads, March.

"New **Heavy Taxiway** for Old" at Carswell Air Force Base, Texas, where new concrete pavement 17-in. thick is replacing old concrete. By Wilbur A. Blain, of Corps of Engineers. Roads & Streets, March.

• • •

An Experiment in Parking

An "experiment" is being conducted by Alexandria, Minn., according to Minnesota Municipalities, in an attempt to eliminate excessive double-parking in the business area. Six parking stalls in each block are reserved for five minutes free use for those who wish to pick up merchandise or make deliveries. Overtime parking fines have been reduced to 50¢ if paid in person or through courtesy boxes within 24 hours, but the fee of $1 still stands for those paid after the one-day period.

Aerial Mapping is on the Increase

A detailed aerial survey, covering the ten square mile area of the city of Salisbury, N. C., and its outlying districts, is being performed by Aero Service Corporation of Philadelphia. The company is carrying out the two-fold survey, including photo-maps and topographic maps, at a cost of $10,531 to Salisbury.

Aerial photography of the entire City and adjacent areas, the first step in the survey, required only one day of flying. An accurate photomosaic or photo-map will be compiled from the photographs at a scale of one inch equals 400 feet. This mosaic will be used by the city for general planning purposes.

In addition to the photo-mosaic, detailed topographic maps, used in engineering projects, are being prepared for selected sections of Salisbury. Shown in detail on this type of maps are buildings, rivers, railroads, power lines and land contours. The topo maps will have two foot contour intervals and a scale of one inch equals 100 feet.

Other North Carolina cities having aerial maps made recently were Durham, Raleigh and Greensboro.

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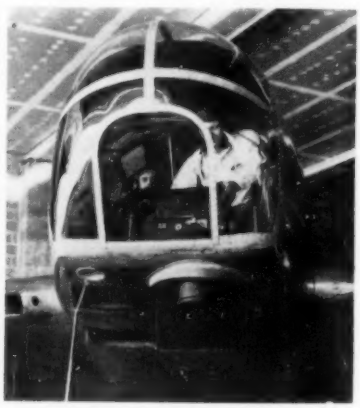
Ohio Has Its Own Aerial Surveying Section

A COMPARATIVELY recent development in highway planning in Ohio is the Highway Department's Aerial Engineering Section, the only state controlled aerial engineering service that is equipped to plan a highway down to the final construction plans. Its photo laboratory includes three darkrooms, a 20 x 24-inch copy camera and a refrigerator for storing films. This laboratory can handle anything from snapshots to 40 x 40-inch prints.

In its photogrammetry section, 4 stereo-plotters transfer detailed information from photographs to maps. Using these maps the preliminary engineering section can locate the exact route to be used, and the design section can prepare the actual construction plans.



An Ohio aerial survey plane

In addition to its work in highway construction, the section also provides photographic and mapping service for Right-of-Way, Traffic & Safety and Maintenance; and for two other state agencies, Natural Resources, and Public Works. For example, it photographs strip mines to be sure that they are properly reforested in compliance with Law.

Last year the photogrammetric unit prepared 176 site plans for bridges, 12 topographic maps and 28 miles of cross-section. This saves engineering manpower and assures that the most economical route will be found. The maps produced by the section show all the surface features necessary for consideration of routes —many more than could be gotten from a ground surveyor's notebook. With these maps, engineers are not limited to a few possible routes, but are free to experiment with virtually any number of routes within the 2,400-yard strip covered by the aerial map.

Placing an 8-ft. long section of 96-in. diameter reinforced concrete pipe in a culvert structure for Moccasin Kill under the New York Thruway in Schenectady County at Rotterdam Junction.

Backfilling operations on the completed portion of a 21-in. concrete pipe drainage system for the Mohawk section of the New York Thruway in Schenectady County near Rotterdam.

Culverts and Drainage on New York Thruway require over 175 miles of CONCRETE PIPE

The longest express highway ever built—the 427-mile New York Thruway—reaches northward from New York City to Albany, then westward past Schenectady, Utica, Syracuse and Rochester to Buffalo. The difficult terrain necessitated cutting through or leveling hills, filling valleys and draining marshland.

Protection of the Thruway requires a complex system of culverts and drainage lines. This includes 175 miles of concrete pipe. About 600,000 ft. are used for culverts, 150,000 ft. for storm sewers and 28,000 ft. for other facilities.

Concrete pipe is an ideal choice for culverts and storm drains. Its great strength resists severe impact and sustains heavy overburdens in deep fills. Its smooth interior finish speeds drainage and provides maximum hydraulic efficiency even under the toughest service conditions.

You get more high-efficiency drainage for the money when you specify concrete pipe for storm sewers, drainage lines and culverts. Low in first cost, concrete pipe drainage systems give long years of service with little or no maintenance. These important factors add up to *low annual cost*—the true measure of pipeline economy.

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Slurry Seal for Street and Highway Surfaces

FRITZ ZAPF
City Engineer
Monrovia, Calif.

THE PROBLEM of maintaining our street and highway surfaces has long been a costly one. In addition, the proper method of protecting street surfaces has always been questionable on a long-range program. A new type of surface treatment was initiated about three years ago by the Los Angeles County Road Department under the supervision of County Road Commissioner Sam Kennedy. M. I. Thompson, Assistant Maintenance Engineer in the Department, is the pioneer in this new application generally referred to as "Slurry Seal." This slurry seal is particularly applicable to old bituminous pavements that have raveled or cracked. Experiments have also been conducted successfully in the County of Los Angeles, applying the slurry seal on old concrete surfaces that were badly pitted or washed out.

The slurry seal consists of a mixture of fine aggregate and a mixing type of emulsion and water to form a very wet slurry. The City of Monrovia, Calif., has experimented with three mixes: 1) Fine mix, using one ton of rock dust, 33 gallons SS-2 emulsion and 30 gallons water; 2) Dust and sand made of ½ ton of rock dust, ½ ton plaster sand, 33 gallons SS-2 emulsion and 30 gallons water; 3) Coarse mix, using 1400 lbs. rock dust, 400 lbs. plaster sand, 200 lbs. No. 4 rock, 33 gallons SS-2 emulsion and 30 gallons water. The water can be varied and the important requirement is proper consistency. Slight excess of water does not reduce the quality of the mixture, though a lack of water reduces consistency and makes application difficult. The warmer the weather, the more water should be added. In cool weather the water should be reduced for this allows for proper proportioning and gives a minimum time for curing or setting. Ideal conditions for slurry coating are temperatures from 65° to 85° and warm evenings. Cool evenings lengthen the setting time and pick up or breaking of adhesion may occur.

A number of gradations of aggregate were designed and all met with success for the design condition. The smoother the street surface the finer the aggregate used.

The rougher the street surfaces, requiring filling, the coarser the mix should be. It is obvious that if the fill becomes greater than about one-quarter inch, a longer setting time will be needed and more shrinkage can be expected. The general practice is to use a 50-50 ratio of rock dust and plaster sand. This gives a practical mix which will satisfy the majority of our conditions. Results show that a perfect gradation is not necessary, but it is advisable. Consistency of gradation is the important object towards good application. On a street that requires two courses it is advisable to use the first application with a coarse mix and a fine mix for the second application.

The emulsion generally used is mixing type emulsion (SS-2) with a penetration 60 to 70 range. The advantage of a mixing type emulsion is that it can be diluted and mixed with any amount of water without harm. The only way it can be broken down is by removal of the water. By using SS-2 emulsion, streets can be opened to traffic soon; and it is not as messy as the softer asphalts. Also SS-2 is a little more stable under high sustained temperatures.

Applying Slurry Seal

Prior to the slurry treatment all weeds must be removed and the roots treated. The entire street surface should be thoroughly swept and cleaned. The surface to be treated should be sprinkled approximately 30 to 45 minutes before the surfacing is started. Enough water should be added to cool and wet the pavement properly. The cracks and the surface should be allowed to absorb as much water as possible. Immediately ahead of the operation a fine nozzle spray should cover the surface to be slurried.

The emulsion and water are placed in a transit mixer first and the aggregates added slowly to mix properly. The slurry is then poured from the transit-mix truck onto the pavement inside a spreader box. This box consists of a rectangular frame 10 to 12 feet wide which is equipped with an adjustable rubber screed for a squeegee. The screed can be raised or lowered to fit the crown of the road or to control the thickness of slurry. In City work, additional help should be available to assist in dressing the beginning and ends of the runs. This will produce a uniform and pleasing looking pavement. On rural roads, traffic can use the treated surface within four hours. In cities it is advisable to keep traffic off the surfacing from 8 to 24 hours, depending on weather conditions, until the slurry has set properly. The thicker the coat, the longer the traffic should be kept off.

For maintenance work slurry seal has unlimited advantages and does an excellent job of sealing cracks, leveling "washboard streets" and providing a good riding surface. The costs are relatively low—0.7¢ per square foot. One truck load (3 cubic yards) will cover 5,000 to 20,000 square feet and can be spread in 7 to 15 minutes. One load costs approximately $35 delivered, including the spreader box. Adjustments of manhole frames and covers are not necessary.

Preventive maintenance is such a predominant factor in our current work that it is anticipated that this method will be used to cover the whole city (residential streets) within five years. Patching and maintenance expenditures will be brought down to an absolute minimum. Estimates for the City of Monrovia show a saving of $40,000 to $50,000 annually on patch work alone.

In City work the neighborhood

"BEALE STREET BLUES"

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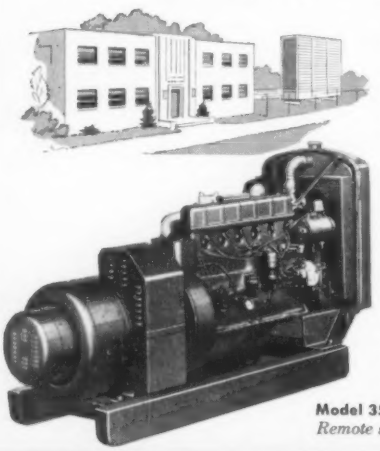

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often must be "sold" on this new type of treatment. Some object to the "messy" look the application has before setting. However, the appearance of the finished treatment is pleasing. Slurry has a tremendous affinity for the surface to be treated and clings tenaciously, providing a tight seal. It is a natural for sealing raveling joints at the gutters and leveling and sealing utility trench cuts. It does an excellent job of leveling and smoothing out local depressions, washboards and general rough pavement.

There is no limit to its potentialities provided care is used on its application. This slurry will not cure subgrade failures, but it will preserve crowns and eliminate future street reconstruction needs for many years. Other uses are the reactivation of and adding a wearing surface to badly eroded concrete pavements. The County of Los Angeles has experimented on this type of application and results have been favorable. A gutter built up with slurry has been successful. The County of Los Angeles has applied slurry to badly eroded asphalt gutters with good success. Future uses are unlimited. Trial tests include the following: Paving trench cutouts with slurry, using combinations of fine and coarse aggregates; wearing surfaces with thicker application for heavy-duty use; shoulder repairs or maintenance and reactivating asphalt sidewalks.

This is part of a paper given by Mr. Zapf at the Highway Conference held recently at the University of California.

• • •

Fish for Algae and Aquatic Plant Control

In the Fena reservoir, Guam, fish were planted to control seaweeds, rockweeds, insect catching water plants, pond scum and similar growths. The fish used for aquatic plant control were tilapia mossambica, but other fish are also being added—bluegill and bass for biological balance and guppies (lebistes reticulatus), the latter to aid top minnows in mosquito control.

• • •

Cost of Water Department Injuries in Detroit

There were 288 injuries among the 1422 employees of the Detroit Water Department during the fiscal year ending June 30, 1955. Of these, 48 involved lost time. The average cost per injury amounted to $43.99, including compensation and medical charges.

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Good street lighting is good civic advertising. Both industry and commerce are favorably attracted to a well-lighted community. In fact, one progressive mid-western town found that its rate of industrial growth climbed 75% above the state average after it installed a modern street lighting system.

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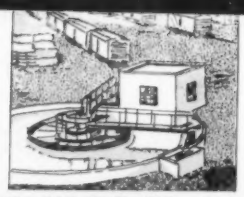


PUBLIC WORKS DIGESTS

THE INDUSTRIAL WASTE DIGEST

A $900,000 Waste Treatment Plant

In 1952, General Electric Co. built at Louisville, Ky., a manufacturing plant containing 3,700,000 sq. ft. of floor space. The wastes produced in 1955 averaged, in gallons per day, 2,880,000 acid - alkaline rinse; 56,400 chromium rinse; 128,600 cyanide rinse; and 295,000 sanitary sewage. These are treated so as to produce an effluent which can be discharged into the metropolitan sewers. The treatment plant cost $900,000 to construct and $132,000 a year to operate. This treats the acid and alkaline, chromium, and cyanide wastes. Each of these is conditioned separately by chemicals; then all three are combined in a final equalization and adjustment basin. During the first six months of 1955, there were used 186 tons of lime, and 30 tons of chlorine, with smaller amounts of caustic soda, calcium hypochlorite and sulfur dioxide.

"Solving a Large - Scale Waste Problem at Appliance Park." By Kenneth S. Watson and C. M. Fair, of General Electric Co. *Sewage and Industrial Wastes*, January.

Fluoride Determinations

The determination of macro quantities of fluoride is a problem of major analytical concern. Considerable work has been published on techniques of decomposition and separation, the latter commonly using a modification of the Willard and Winter steam distillation procedure. The separated fluosilicic acid can be analyzed gravimetrically or volumetrically. Both methods present certain problems or limitations, hence the investigation of the applicability of a high frequency oscillometer to one of the fluoride reactions. The advantages of the high frequency method are not due to increased accuracy or sensitivity over conventional electrometric procedures, but lie in the convenience of operation, the ability to show the end points for reactions which are masked when other indicators are used, and the absence of physical contact of electrodes with the solution. The disadvantage is the uncertain relationship between the indicated end point for a reaction and the stoichiometric equivalence point. This method employs a modification of the Willard and Winter steam - distillation method, followed by accurate adjustment of the pH, and titration with thorium nitrate using a high frequency oscillometer for end point detection. In the range of 3 to 8 mg. of fluoride per 100 ml. of solution, the average accuracy is within 0.2%. The method has the advantage of being rapid and is easily adaptable to automatic recording.

"Oscillometric Determination of Fluoride" by Clarence L. Grant and Helmut M. Haendler, Dept. of Chemistry, University of New Hampshire. *Analytical Chemistry*, March.

Oxidation of Oil Contamination

The objectionable features of oil contamination that are detectable by sight, smell, or touch are well known and eventually disappear from polluted water. Other effects are not so well understood. Investigations were conducted to show the degree of biochemical oxidation of oil under specific conditions. The biochemical oxidation of oil was followed by infra-red analysis and the determination of the principal oxidation product, carbon dioxide. This provided data on the oil concentration, intermediate, land products and biological activity at any given time. Many intermediate oxidation products are possible such as peroxides, alcohols, diols, aldehydes, acids, ketones, ethers, and esters. The intermediate compounds as formed are in turn oxidized into carbon dioxide and water. The infra-red carbonyl absorption of the acids and esters was important as a rate indicator for oxidation. High water temperatures are favorable for the reaction. Common microorganisms in surface water are capable of oxidation of oil. Oil contamination of water presented two types of problems. Persistence and the inhibition of the oxidation of other wastes present. "Persistence of Oily Wastes in Polluted Water under Aerobic Conditions." By F. L. Ludzak and Diana Kinkead, Robert A. Taft Sanitary Engineering Center, U. S. Department of Health, Education and Welfare, Cincinnati. *Industrial and Engineering Chemistry*, February.

Biological Treatment Of Petroleum Wastes

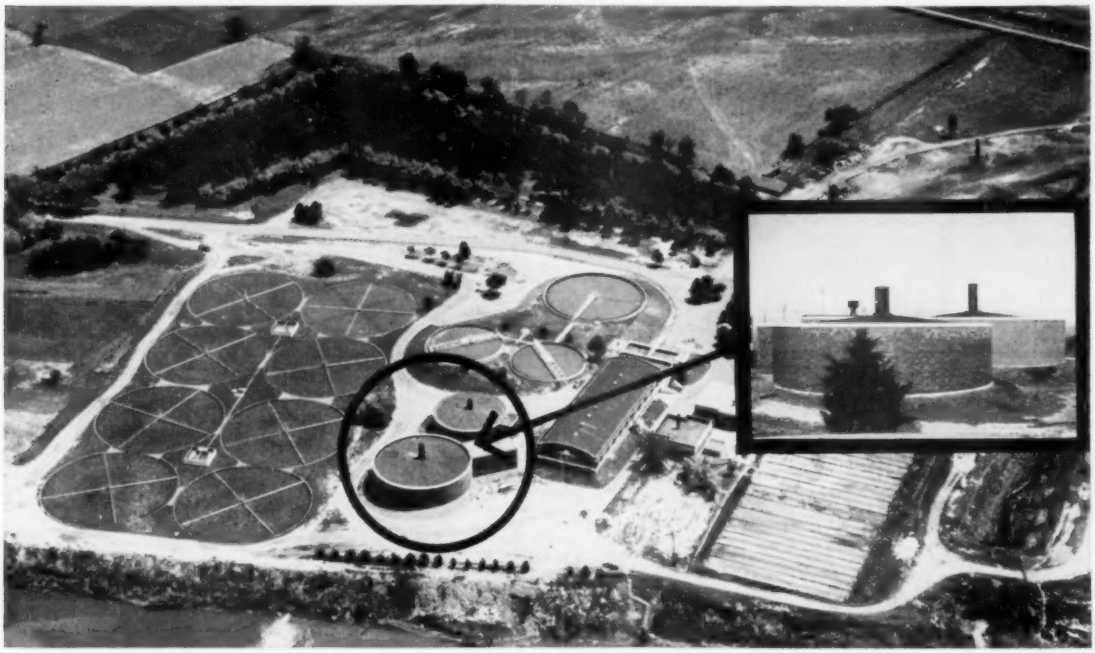
Components of the waste waters from an oil refinery may include oils, waxes, phenolates, caustics, acids and many other organic and inorganic contaminants. The Atlantic Refining Co., at a plant in Philadelphia, conducted a series of tests in a large pilot plant which proved that its wastes were treatable by activated sludge, but modifications to adapt the aeration process to refinery wastes and better preparation and conditioning of the influent are indicated. In using a high rate activated sludge process the sludge tended to float in the clarification unit and use of dissolved air flotation in place of final sedimentation is suggested.

"Biological Treatment of Petroleum Wastes." By Robert A. Baker and Roy F. Weston, of Atlantic Refining Co. *Sewage and Industrial Wastes*, January.

Continuous Record of DO Content

A method has been developed for obtaining a continuous record of the dissolved oxygen content of water. Determination is made by analysis of a gas whose composition conforms with the dissolved oxygen content of water by Henry's law. The system consists of a fixed volume of gas saturated with water vapor within the aspirator unit, through which water flows at a constant rate. Water is continuously withdrawn from the bottom of the unit at a rate that maintains a constant liquid level and thus a constant gas volume. Two critical components of the instrument, the gas analyzer-recorder combination and the liquid level

Circled area shows 2 PFT Floating Covers—long building to the right contains 5 rectangular PFT Floating Covers



Lincoln, Nebraska continues modernizing

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This unusual trickling filter plant at Lancaster Sanitary District #1 in Lincoln has undergone 3 major expansions in 18 years. It provides an excellent example of building for modern treatment on the base of full utilization of existing structures.

In its 1937 expansion, the District converted 5 small rectangular Imhoff Tanks into digesters, installing a *PFT Floating Cover* on each. Floating Covers were chosen for their positive scum submergence, flexibility of operation and safe utilization of gas.

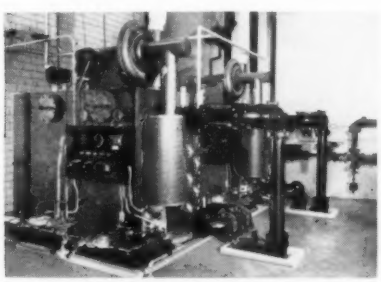
Another digester was added in 1941 — a 65′ circular digester, again equipped with PFT Floating Cover along with PFT Gas Safety Equipment.

Lincoln's latest expansion came in 1953 when an 85′ diameter digester with PFT Floating Cover was installed. In addition, a *PFT Heater & Heat Exchanger* unit was added (750,000 B.T.U. per hr.) for efficient and economical sludge heating. Fired by the sludge gas itself, the heater consumes the absolute minimum of purchased fuel.

A well planned gas safety system was also installed in 1955, including the following PFT equipment: Waste Gas Burners; Flame Trap; Pressure Relief with Flame Trap; Drip Taps; Auxiliary Flame Cell; Gas Check Valves; Gas Pressure Gauge.

Congratulations to Lincoln on making excellent use of older equipment in building a highly modern, efficient plant!

Design of plant by / *Black & Veatch, Consulting Engineers, Kansas City, Mo.*



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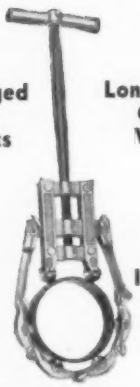

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control, require further refinement, but these problems can be solved in the course of normal development. None of the components of this instrument need be large or heavy; thus a truly mobile instrument can result from proper engineering development. The Robert A. Taft Sanitary Engineering Center plans to complete its work on development of this analyzer unless an instrument with acceptable performance characteristics is developed earlier by private industry.

"Continuous Measurement of Dissolved Oxygen in Water", by H. S. Levine, W. V. Warren, E. C. Tsivoglou, and W. W. Walker, U.S.P.H.S. Robert A Taft Sanitary Engineering Center, Cincinnati *Analytical Chemistry*, March.

Utilizing Spent Sulfite Liquors

One process (sulfate) for converting wood chips into cellulose fibers makes use of an alkaline liquor as a digesting medium which, after dissolving the noncellulosic materials, is drained from the cellulose fibers. The recovery of the alkaline cooking chemicals is a relative simple process, which today is developed to a high degree of efficiency, returning not only the cooking chemicals but also steam and energy to more than pay for the recovery process and leaving a minimum of effluent to the mill sewers. The other major pulping process (sulfite) uses a solution of calcium bisulfite and sulfur dioxide as a cooking liquor. The low cost of the chemicals made it economically permissible to discard the spent liquor but this practice represents an enormous waste of a potentially valuable organic material. In the U.S., 3,000,000 tons have gone to waste each year in the form of discarded sulfite liquor. The fact that even today only a small percentage of spent liquor from sulfite pulping is utilized means that a generally acceptable processing method for this by-product has still not been found. In Sweden sulfite pulp mills are producing 20 mg per year of 95 per cent ethonol from spent liquor. Two mills in Canada and one in the U. S. are producing ethanol. In Germany a process to develop *Torula utilis* was discovered and the Wisconsin Sulphite Pulp Manufacturer's Research League, Inc. have established practical and effective means of propagating such yeast on spent sulfite liquor and recovering it in marketable quality. Two Wisconsin plants now produce about 7,000 tons of dry yeast per year and in so doing reduce the BOD of the liquor processed by about 60 per cent. Another approach to the spent sulfite liquor problem was the precipitation of spent liquor components as separate, distinct fractions by controlled addition of lime slurry. The first step in the production of a precipitate of calcium sulfite is adding lime slurry to the spent sulfite liquor to a certain strictly controlled pH level. The precipitate is used in the calcium bisulfite-SO_2 cooking liquor make-up system. The clear overflow and filtrate from the first step are treated with further amounts of lime slurry to produce a yellow flocculated precipitate consisting mainly of basic calcium lignosulfonate. As this represents about 50 per cent of the spent sulfite liquor solids, about 1,000 pounds is obtained from 1 ton of pulp produced. A process was developed for the alkaline hydrolysis of lignosulfonate, wherein vanillin was obtained as a cleavage product of the lignin, and the resulting effluents became a source of partially desulfonated lignosulfonates. These desulfonated lignosulfonates indicated their potential value as dispersing agents and have gained acceptance in a wide range of industrial applications. "From Waste and Nuisance to Use and Profit." By J. Richter Salvensen, *Industrial Wastes*, Jan.-Feb., 1956.

Symposium On Air Pollution

Air pollution might affect health through inhalation of polluted air, ingestion of food or water contaminated by polluted air, direct irritation of parts of the human body, decrease in solar radiation available at the ground level, and subjecting people to the psychological impact of living with air pollution. The intensity may run the gamut from severe episodes causing death, recognizable illness, mere annoyance, or chronic effects from prolonged exposure. In some instances of severe results, the synergistic effects of two or more pollutants were suspected. Weakness of the individual from age or illness appears to increase susceptibility. There are great difficulties in pin-pointing cause and effect relationships, especially at lower levels of pollution where chronic exposures are involved.

Conclusive evidence obtained in air pollution investigations has shown the problem to be related to photochemical phenomena. Certain hydrocarbon vapors in sunlight and stable air can oxidize to form chemically complex aerosols and vapor-phase oxygenated hydrocarbons. The

How long to bridge this 62-foot span . . .

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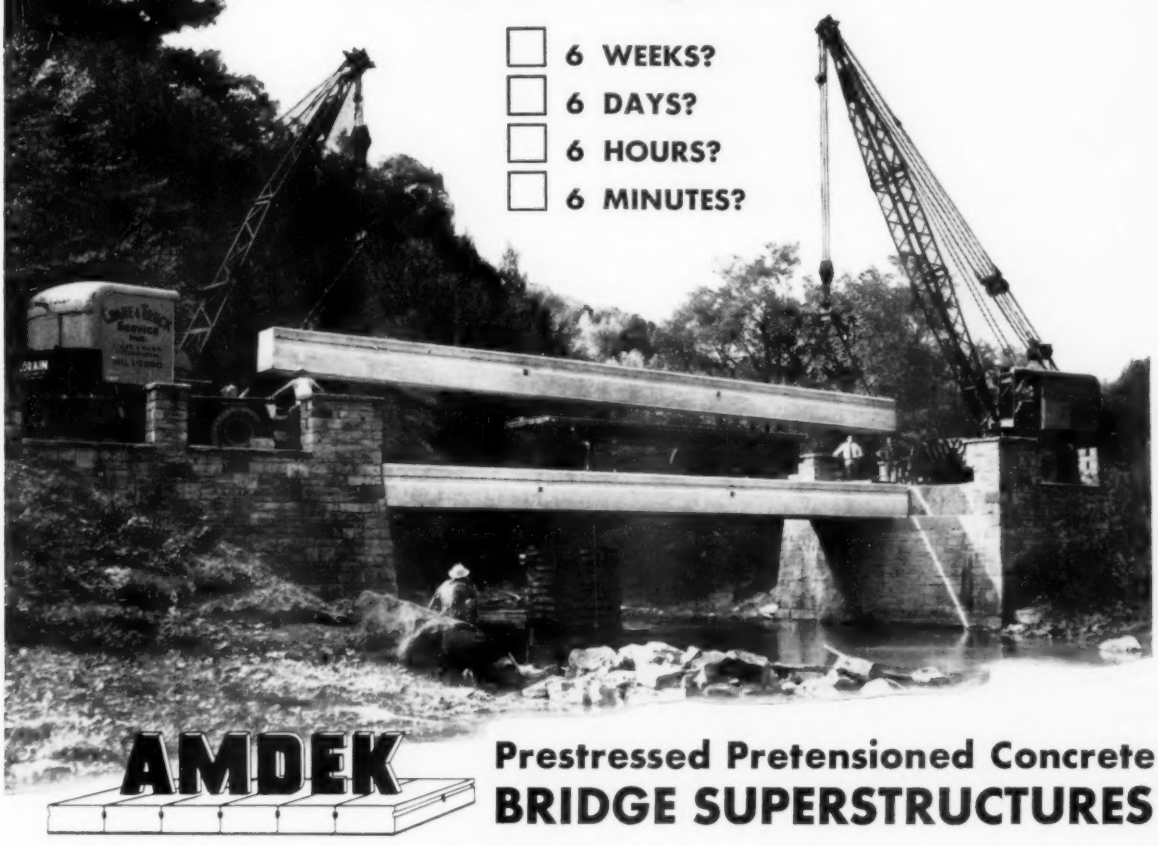

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most important types of these hydrocarbons are the olefinic, branched chain and cyclic compounds. A by-product of the reaction where oxides of nitrogen are present is the production of ozone. In general, hydrocarbon contaminants can be removed by adsorption or oxidation techniques. Several companies including the petroleum and motor industries are investigating the possibility of excluding hydrocarbons from the exhausts of automobiles and diesel engines.

Legislation and regulations governing air pollution control have been instituted in cities numbering in the hundreds. In a number of instances Model Smoke Ordinances have been promulgated, often without regard to specific problems of application. There is a need for delineation of the activities which should be undertaken by the several levels of government. The basic conditions for sound legislation are that any ordinance must be backed by enforcement; that any legislation should be considered, in a sense, as being a contractual obligation showing sincerity of purpose on the part of aggrieved parties and those causing pollution; and that an ordinance can be maintained only through continued wholehearted support of the citizenry. An acceptable method for controlling inter-city and inter-state air pollution is in great demand and has yet to be devised.

While every community has polluted air to some extent, there is a realization of a problem existing when (1) the general health of the community is affected to the proportions of disaster; (2) the nuisance is beyond the tolerance of the citizens; (3) the contaminants have a deteriorating effect on the production capacity of an industry. A practical approach to the problem may involve (a) voluntary civic effort, (b) voluntary effort fostered by ordinances, or (c) a comprehensive program backed by an effective ordinance and enforcement. Many small communities depend on (a) above. Most successful efforts have resulted from (b) and (c). One of the biggest problems is—can an acceptable standard be set for the quality of outdoor air?

The prevention of air pollution is fundamentally a problem in source control, and progress has been made in this direction; but the policy of removing pollutants at their source cannot be followed exclusively because many sources cannot be controlled. Therefore, consideration must be given to such removal in the design of building ventilation systems.

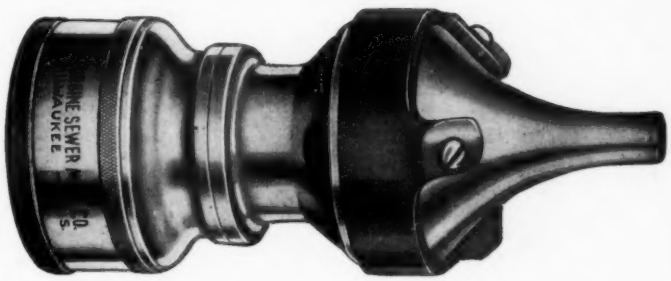
Air pollution control activities cost

each inhabitant as low as two cents per year to as high as $1.42. The number and complexity of duties required will determine the size of the control bureau rather than population or area factors. The control detail outlined in the ordinance has an effect on the personnel requirements. Analysis and evaluation procedures require highly trained personnel and well-equipped laboratories. Nearly all control offices issue installation permits, with the object of preventing further pollution even though new sources are added. Minimum standards are needed to assure uniform inspection and to serve as a guide to the less initiated. The regulation of the type of fuel that may be burned demands considerable work. In smaller communities, time and effort can be saved by putting the responsibility directly on dealers for delivering the proper fuel. Punishment for violations usually involves two methods: (1) the sealing of offending equipment and (2) the assessment of fines upon conviction.

"A Symposium on Air Pollution", presented at the Annual Meeting of the American Society of Heating and Air Conditioning Engineers, Cincinnati, January 25, 1956, C. H. Pesterfield, Michigan State University, moderator; W. C. Cooper, M.D., and A. C. Stern, Public Health Service, Cincinnati (Public Health Aspects); G. P. Larson, Oxy-Catalyst, Inc., Wayne, Pennsylvania (The Growing Air Pollution Problem); H. C. Ballman, Executive Secretary, Air Pollution Control Association (Control Legislation and Regulations); C. W. Gruber, Air Pollution Control and Heating Engineer, City of Cincinnati (Practical Approach to Problems); J. W. May, American Air Filter Company, Louisville (The Cleaning of Air Pollutants); and J. H. Carter, Commissioner, Division of Smoke Regulations, City of St. Louis (Enforcement of Air Pollution Ordinances and Regulations). *Heating, Piping, and Air Conditioning*, March.

Jar Test Control Of Chemical Treatment

The Buick Jet Engine and Fisher Bodies plants at Willow Springs, Ill., produce a total of about 135,000 gpd of wastes, of which 51 percent are oils, 9 percent emulsifiers, 6 percent alkaline, and 25 percent cooling and washing water. Two 150,000 gal. wastes-receiving tanks equipped with slow-mixing agitators and surface skimmers receive all the raw wastes alternately. There are two clarifiers and two Cyclators; perco-



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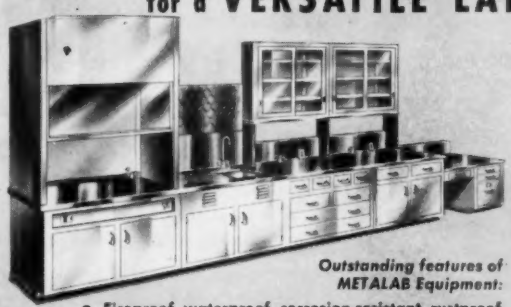

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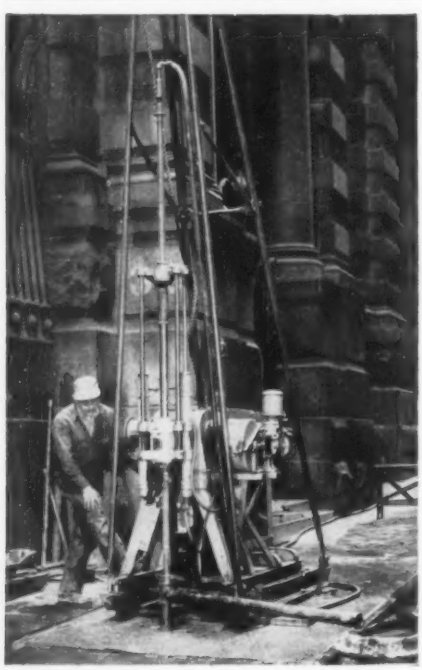

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lating sludge beds receive the sludge. When one tank has been filled, it is mixed for 30 minutes, and jar tests are then run on samples to determine the chemical feed rates required for primary and secondary treatment. The wastes then flow to a mixing tank where a coagulant is added and thoroughly mixed. The flocculated wastes then enter the Cyclators, where hydrated lime is constantly being injected. The guidepost for the entire operation is the jar test analysis, which determines the kinds and amounts of chemicals to be added. To date this plant has reclaimed 78 percent of the lubrication oils used in the plants. The cost of treatment has varied from 7 to 15 cents per 1,000 gal. of waste.

"Controlling Chemical Treatment by Use of Coagulation Jar Tests." By K. W. Newton and G. W. Wagner, of the Buick Jet Engine Plant. *Wastes Engineering*, March.

Other Articles

"Processing of **Phosphorus Furnace Wastes**" by coagulation concentrates suspended solids 40-fold. By John P. Horton, J. Douglas Malley and Harold C. Bays, of Virginia-Carolina Chem. Corp. Sewage and Industrial Wastes, January.

• • •

Trickling Filters in Series Give Good Treatment

Two-stage treatment of settled sewage by trickling filters without intermediate sedimentation has been found to be an effective process by sanitary engineers at the Texas Engineering Experiment Station, University of Texas.

Studies were made by J. H. Sorrels and P. J. A. Zeller who investigated the degree of purification accomplished by a trickling filter at excessive loadings without recirculation in comparison with that afforded by filters in series.

Four experimental filters were dosed with settled sewage by means of orifices in a constant head tank. The effluent from each of these primary filters passed directly to a corresponding secondary filter without intermediate sedimentation. Each secondary filter was four feet square, three feet deep, and had a motor driven spinner to assure good distribution. The effluents from the secondary filters dropped into a channel, so that each secondary effluent could be sampled individually. Operation of all filters was continuous.

For a test run, samples of influent and effluent were taken hourly from 8 a.m. to 5 p.m. Composite samples

were stored in a refrigerator. Time of flow of a measured sample was recorded hourly. As required, the orifices in the constant head tank were adjusted to maintain the flow at the desired constant rate.

Composite samples, except settled sewage, were settled in an Imhoff cone for 45 minutes, and the amount of settleable solids recorded. About half a liter of clarified liquor was carefully siphoned off and analyzed by standard methods for pH, BOD, suspended and volatile solids, ammonia, nitrites, and nitrates.

The dosage rates of the primary filters were 1000, 2000, 3000, and 4000 pounds of 5-day BOD per acre-foot per day. The dosage rates of the secondary filters, that portion of the BOD which was not removed by the primary filters, were not subject to close control, and showed rather wide fluctuations but averaged 700, 1700, 3200, and 5600 per acre-foot per day, respectively. The corresponding hydraulic rates of application were, respectively: 4.46, 8.92, 13.38, and 17.83 million gallons per acre per day for both primary and secondary filters.

Within the loading range of 1000-4000 pounds of 5-day BOD per acre-foot per day applied to primary filters several results were observed. The BOD removal increased from 636 to 1426 pounds per acre-foot per day at 3000 pounds loading, but dropped to 1130 pounds at 4000 pounds loading. The percentage removal decreased consistently from 63.6 to 28.7 resulting in a poorer quality effluent ranging from 59 to 116 parts per million BOD. Suspended solids removal increased from 523 to 1348 pounds per acre-foot per day at loadings ranging from 814 to 3207 pounds per acre-foot per day. It was learned also that roughing filters do not produce a satisfactory effluent for discharge.

Intermediate sedimentation in series filtration did not seem to be necessary since no abnormal sludge was obtained.

At the loadings used in these studies no nitrification occurred in the primary filters. Nitrification did occur in the secondary filters but at a decreasing rate up to loadings of 3100 pounds of 5-day BOD per acre-foot per day. At this loading no nitrification was evidenced.

It was found that, at the same BOD loading, series filtration affords a higher degree of treatment than single stage filtration even at higher hydraulic rate.

The experiments covered a two-year period to compensate for seasonal variations. This description is from the Experiment Station News.

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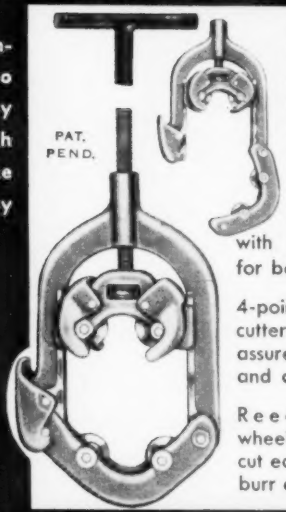

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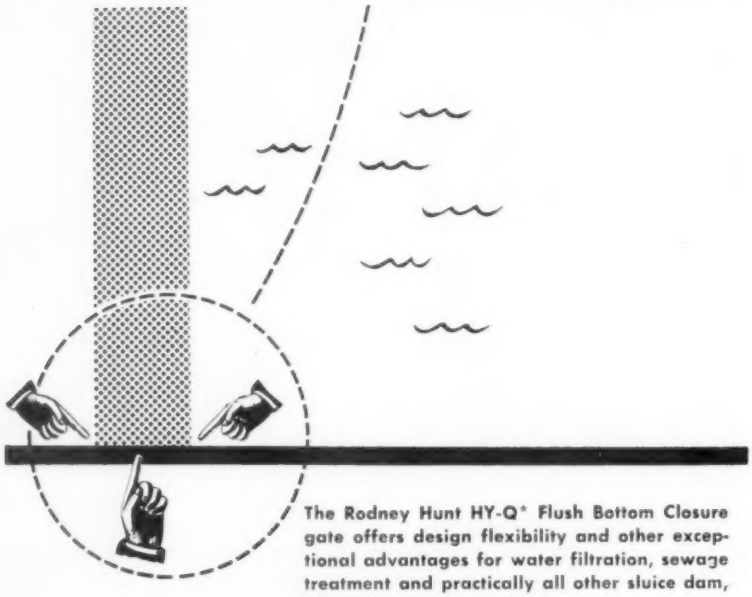

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Salt and Calcium Chloride Used for Snow and Ice Control

City engineers and superintendents of public works replied to a questionnaire from PUBLIC WORKS Magazine regarding use of salt, calcium chloride and inhibitors for snow and ice control. Of about 850 replies, 489 cities stated they used one or the other or both chemicals for safeguarding winter traffic. Of the 489, 98 reported that they also used inhibitors to prevent damage to vehicles from chemical action. Southern cities, of course, do not need to remove snow or ice, and did not reply to the question. This indicates that most northern cities rely on salt and calcium chloride as a first line of defense against winter storms.

• • •

An Ocean-Based Automatic Weather Station

A prototype marine weather station that automatically reports local weather data by radio has been developed by the National Bureau of Standards. The unit is incorporated in a buoy that can be anchored in remote locations and left unattended for periods up to six months. At regular intervals throughout the day, the station broadcasts in code the air temperature, water temperature, barometric pressure, and wind speed and direction. Preliminary tests in Chesapeake Bay show that the station has a radio range in excess of 800 miles. The equipment was developed by P. D. Lowell, W. Hakkarinen, and L. M. Allison of the Bureau's electronic instrumentation laboratory for the Navy Bureau of Aeronautics.

At the present time the gathering of comprehensive weather data from many ocean areas outside of regular shipping lanes is haphazard and limited. Both military and civilian authorities would be better able to predict weather conditions if they received continuous weather reports from a much wider area. If a series of stations similar to the Bureau's prototype station were placed over wide areas of the Pacific Ocean, for example, they could give operations officers and meteorologists frequent reports making possible a complete weather picture for the entire ocean. If moored in certain areas of the Caribbean, these stations might also give warning of hurricanes as they begin to form.

The automatic station translates information from each of five weather sensing elements into three-letter groups in continental code and trans-

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mits the coded signals on a pulse-modulated carrier frequency at about 6 megacycles. These signals can be received on standard communications receivers and compared with a decoding table which gives numerical values for each of the meteorological variables measured. A single transmission takes three minutes. During this interval six items of information are broadcast. The first transmission is a three-letter signal identifying the station. Coded transmissions follow containing information on (1) air temperature between —25° and +110°F, (2) water temperature between 15° and 90°F, (3) barometric pressure between 950 and 1050 millibars, (4) wind speed from 0 to 68 knots, and (5) wind direction oriented from magnetic north.

• • •

Letters to the Editor

(*Continued from Page* 16)

ognition. They are primarily concerned, not with the job itself, but where the job leads—what they will be doing ten years from now. Unless an organization can show plenty of opportunity, it is not going to be able to hire the best men. Unfortunately, many of our highway organizations fail to measure up in this respect. The graduate can see himself, ten years from now, as a project or assistant division engineer at a salary of perhaps $8,000. This future does not attract the better men.

Obviously, there are many factors. However, existence of attractive opportunity is one thing that should be stressed and proved. I am very pleased with this series and am sure it will have some tangible results.

L. J. Ritter, Jr.
Naperville,
Illinois.

Please forward me 20 reprint copies of your articles "Opportunities in Civil and Public Works Engineering" which appeared in your March issue; also of the eight articles to appear in the future. These will be entered in the library of the Skagit Valley Junior College and in five of our County High Schools.

R. A. Yale
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Mt. Vernon, Wash.

We have noted with interest the "Opportunities in Civil and Public Works Engineering" in your March issue. This is exactly the type of service we believe most useful in encouraging talented students to pursue engineering careers.——In order that we may alert our personnel, please advise us of the author and the time of issue of the article dealing with opportunities in sanitary engineering.

Edmund J. Laubusch
Office of Engrg. Resources
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Public Health Service
Washington, D. C.

Please forward twenty copies each of your series "Opportunities in Civil and Public Works Engineering" to the Personnel Office, City Hall, Pasadena, Calif.

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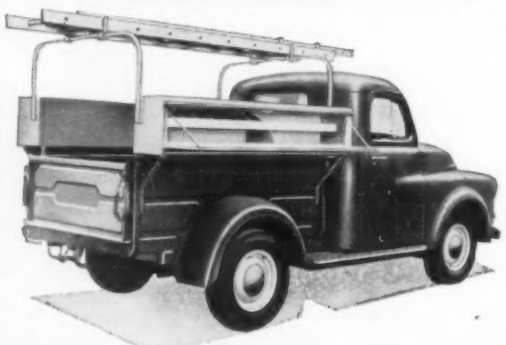

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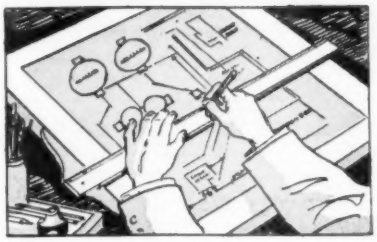

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Actinomycetes May Cause Tastes and Odors in Water Supplies

(*Continued from page* 106)

is not equipped to use this gas, then either activated carbon or a new experimental product now being developed by Calgon, Inc., called Odorex, has been found effective. Usually, if a water plant is interested in producing odor-free water, pre-chlorination should be practiced prior to the addition of either carbon or Odorex. If the threshold odor is 20, one may suppose that it will require 20 ppm of carbon or 5 ppm of Odorex to reduce the odor to 1. We admit that the use of prechlorination requires additional amounts of carbon, but we are further aware that it is the only method that can be used that will guarantee the removal of these organic amines that are producing the odors and tastes.

Treatment Difficulties

Potato-bin and musty odors pose quite a problem for the water plant operator. Any addition of chlorine will triple or quadruple the threshold odor. It is, therefore, not advisable to attempt to remove the odor without prechlorination since the operator will not know how much odor the water will retain finally. If he attempts to produce an odor-free water prior to chlorination, he will often turn out a tap water that has chloro-derivative odors. With these two varieties of odors we find that chlorine dioxide is helpful, provided again that it can be generated without any available chlorine. It is probably best to prechlorinate, add the Odorex ahead of the flash mixer, if possible, add carbon in the primary sedimentation chambers, and hope that ample reduction in the odor may be accomplished so that the consumer will be willing to accept it. Sufficiently high concentrations of powdered activated carbon will remove the odors and tastes. In this instance, if water had a threshold odor of 20, it would require 60 ppm of carbon to produce a finished water with a threshold value of 1.

The last two odors mentioned, namely woody and earthy, are not economically removed from raw water. Chlorine dioxide will not oxidize these tastes and odors. Break-point chlorination, regardless of concentration, intensifies them. Odorex and carbon will aid in reducing them, but the quantities of either product required to remove them are often unusually high. Much additional investigation must

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be completed before complete control of woody or earthy tastes and odors can be prescribed. At present, the best treatment we can suggest, based on both laboratory and water plant investigations, would be somewhat as follows: the addition of chlorine in a prechlorination practice in concentrations of approximately 5 ppm. If the threshold odor is 20, we suggest the addition of 8 ppm of Odorex, followed by flash mixing and the addition of 20 ppm carbon in the primary sedimentation tanks. The water then would probably have a threshold odor of 1 or 2, but would retain some threshold taste. In order completely to eradicate these compounds from water it would be necessary to add 80 ppm of powdered activated carbon. It should be understood that frequently the threshold odor values exceed 20. We have observed them as high as 80, in which case they would require 320 ppm powdered activated carbon to produce a palatable water.

It appears that the aquatic actinomycetes are versatile organisms that elaborate four groups of organic compounds in their normal metabolism, dependent somewhat on temperature and nutrients. These compounds are aromatic amines, ketones, aldehydes, and aromatic phenols. The odors that are simpler to handle apparently are due largely to amines. As the odors become more complex, we find, in addition to amines, certain aldehydes. As the life-history of the actinomycete continues, ketones become available from the organisms, and, when the odors are woody and earthy, aromatic phenols are also present. Since the sequence of odor production has been established, the water plant operator should be aware of the future developments in the reservoir, river, or lake, by noting the events as they happen.

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PUBLIC WORKS
EQUIPMENT NEWS

Published Monthly **May, 1956**

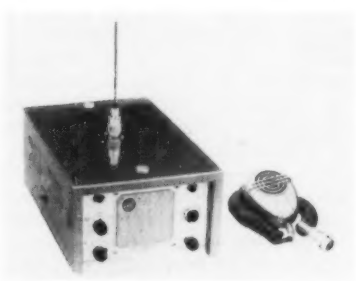
Repair Clamp For Pipe Maintenance

A dual purpose repair clamp for quick repair of cracked or broken pipe, or for connecting two lengths of pipe in the trench, is available from Smith-Blair. The full circle clamp coupling has ball and socket pivoting ductile iron lugs and free floating bolts. These features give increased holding power and make the clamp easy to install on the pipe without service shut-off. By simply opening one side of the clamp it can be dropped over the pipe. The metal bands are made of cold rolled copper or stainless steel and are furnished with silicon bronze or stainless steel bolts for corrosive conditions. Pipe sizes range from 2 through 24 inches. For more data write Smith-Blair Inc., 535 Railroad Ave., South San Francisco, Calif., or circle **No. 5-1** on the reply card.

Quick repair of cracked or broken pipe is accomplished with this repair clamp

Mobile Radiotelephone Increases Vehicle Efficiency

A new and small low power radiotelephone, the IMP, is capable of performing the triple duties of base station, mobile unit and mobile public address system. It has a range of from one to five miles and, without any modification, can operate on 6 volts DC, or 117 volts AC. Weight is 21 pounds, and the installation is simple. For more information write Kaar Engineering Corp., 2900 Middlefield Rd., Palo Alto, Calif., or circle **No. 5-2** on the reply card.



Radiotelephone that is designed for installation in transportation units

A General Purpose 1 to 3-Ton Roller

A newly designed and improved roller, the Ken-Roll, has just been announced by Pfahler Mfg. Co. This light 1 to 3-ton general purpose roller features the close tolerance of a half inch clearance on right side to permit rolling close to walls and posts. The compression roll (with water ballast) delivers up to 85 pounds per lineal inch while with water and steel ballast, the pressure goes up to 138 pounds per lineal inch. The two-section steering roll and truck type steering mechanism adds to the maneuverability and performance. The sprinkler tank has a 93-gallon capacity. More information from Pfahler Mfg. Co., Galion, Ohio, or circle **No. 5-3** on the reply card.

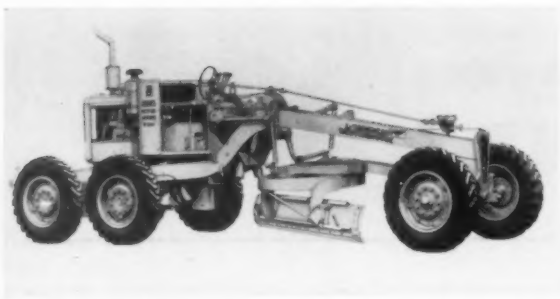
New Seedbed Preparation Tool and Landscape Rake

A new landscape and seedbed preparation tool, the Roseman Tiller Rake, is announced by Roseman-Tractor Equipment Co. The rake can be attached to the 3-point hydraulic lift of most tractors and does several soil working operations with one tool. Through a pitch-control wheel the rake can be alternately positioned to scarify, till, level, spread, grade and finish-rake rough ground into a seedbed with a minimum of labor and equipment. For complete information write Roseman Tractor Equipment Co., 2618 Ridge Road, Evanston, Ill., or circle **No. 5-4** on the reply card.

Portable Combustible Gas Indicator

New portable instruments designed to meet municipal and industrial needs in detecting and measuring flammable gases and vapors has been introduced by Mine Safety. Four models, each intended for specific functions, are included. Each instrument weighs only six pounds and is operated by eight dry-cell flashlight batteries. The instruments will indicate when concentrations are within or above the upper explosive limit and specially designed flame arrestors permit use of the instruments in testing for all flammable gases and vapors, including hydrogen and acetylene in the air. For more details write Mine Safety Appliances Company, 201 N. Braddock Ave., Pittsburgh 8, or circle **No. 5-5** on the reply card.

Gas indicator is used to check atmosphere in sanitary manhole



Grading needs are suitably handled by new Adams "220"

Road sweeper has an easy shifting, four speed transmission

Adams "220" Grader

A new motor grader, the Adams "220", has been announced by LeTourneau-Westinghouse. Powered by a 60-hp diesel engine and weighing 14,865 pounds it is designed primarily for general grading and road maintenance. An outstanding new feature in the "220" is a hydrapower gear system which powers both lift and lateral shift of the blade. Employing hydraulic power for ease of operation and mechanical torque for speed and positive action, this device uses gears to convert the thrust of hydraulic rams to mechanical turning power. The standard sliding-gear transmission provides 5 forward speeds from 1.8 to 18.3 mph. The optional creeper gears add four more speeds from 0.28 to 0.96 mph for finish-grading in tight places, tough rooting jobs and other difficult applications which might otherwise require slipping the clutch or reducing engine power to permit the necessary slow operation. Other important features include a hydraulic-mechanical circle reverse mechanism which revolves the blade under the scarifier block to any angle within a full 360°; power-controlled leaning front wheels; and hydraulic brakes on front tandem drive wheels with a mechanical parking brake on transmission. For information write LeTourneau - Westinghouse Co., Peoria, Ill., or circle **No. 5-6** on the reply card.

A Tool That Repairs Pipe Leaks

A new tool that repairs pipe leaks quickly, permanently and economically, has been introduced by Atlas Industries. It consists of the Atlas pipe clamp and Atlas patches which are accurately shaped to fit specific pipe sizes and to assure a skin-tight fit when the gasket is compressed. The pipe tool is made in two styles: the saddle type in four sizes for pipe 6 inches in diameter and less; and the chain type in all sizes from 6-inch up to any size. The patches are made of steel with either neoprene or asbestos gaskets. The clamp is placed around the leaking pipe—without shutting off line, reducing pressure or causing any loss of time or flow. The patch is applied directly over the leak and sufficient pressure is applied by the clamp to stop the leak. The patch can then be welded to the pipe or the clamp can be left on until it is convenient to weld the patch. Data from the Atlas Industries, Inc., Box 8152, Houston, Texas, or circle **No. 5-7** on the reply card.

Flasher Safety Light for Protecting Construction

A new heavy duty flasher safety light, that provides 60 to 90 days of continuous operation without servicing or battery replacement, is announced by R. D. Fageol Co. Producing approximately 90 brilliant neon flashes per minute, the light is visible for over a mile. Lenses are available in red, amber, clear or any combination of these colors. For further information write R. D. Fageol Company, Kent, Ohio, or circle **No. 5-8** on the reply card.

Model D-2 flasher safety light

Self-Propelled Road Sweeper Announced

A self-propelled road sweeper has been announced by Little Giant Products. This machine is a combination of a prime mover and rotary brush assembly, each with its individual engine. The prime mover has a 48-hp industrial engine, water cooled and electrically started. The brush is powered by a 7-hp air-cooled engine. Dirt, trash, broken stone, snow and other materials are quickly cleaned from any relatively even surface. For heavy sweeping, the brush can be rotated faster and the prime mover driven more slowly. For light sweeping, the brush can be rotated slowly and the prime mover shifted to a faster speed. The rear wheel steering provides a short 11-foot turning radius. Speeds up to 40 mph are possible for travel between jobs. Brushes are 6, 7, or 8 ft. wide. Optional equipment includes a dust-control water sprinkling system, front deflector steel bristle broom, hourmeter, speedometer, tachometer, and temperature gauge. More from Little Giant Products, Inc., 1600 North Adams St., Peoria, Ill., or circle **No. 5-9** on the reply card.

Koehring Announces New 3/4 yd. Excavator with Attachments

Koehring's new ¾ cu. yd. excavator, the Model 305, has a rated lift crane capacity of 25 tons on truck chassis and 15 tons on crawler mounting; and it can be equipped with a full complement of attachments. Safety and wear resisting features include self-cleaning crawlers, automatic traction brakes and newly designed cab and operating lever arrangement. The hoe attachment provides an increase in digging depth to 20 feet and the hoe dipper pulls tight to the boom. Side cutters can be used to advantage to widen a trench or dress an excavation. For data write Koehring Co., Milwaukee 16, Wisc., or circle **No. 5-10** on the reply card.

New Verti-Line Package Pump

A completely new pumping unit for wells as small as 4 inches in diameter has been announced by Layne & Bowler. It is called the Verti-Line Package - Pump and

Completely new pump for wells

comes in two sizes, 4 and 6-inch. These are available in sizes from 2 through 7½ hp; for heads to 340 feet; and in capacities from 200 to 7,500 gallons per hour. Power is by General Electric VHS weather-proof 60-cycle motors with 3600 RPM. For further details write Layne and Bowler Pump Company, 2943 Vail Avenue, Los Angeles 22, Calif. or circle **No. 5-11** on the reply card.

A Radio Communication Equipment Cabinet

A new two-way radio communication equipment cabinet for housing transmitter, receiver and power supply chassis at a fixed location has been announced by General Electric. The new "Desk Mate" base station cabinet was designed as a piece of office furniture to be placed next to a desk. It is about the same height and depth as the average desk and is only fourteen inches wide. For convenience, the operating controls are about the same height as a desk top drawer, allowing the base station operator to adjust the squelch and volume controls without moving from his chair. The cabinet was designed to house a standard nineteen-inch chassis operating in any mobile radio frequency range. For full details write The General Electric Co., Electronics Park, Syracuse, N. Y., or circle **No. 5-12** on the reply card.

IHC Makes Engineering Improvements On 4 Tractor Models

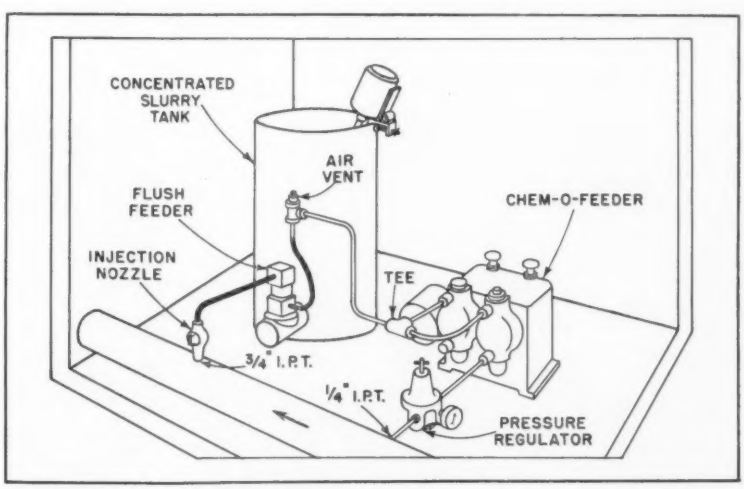
The introduction of a new crawler tractor line, comprised of four models, the TD-18, TD-14, TD-9 and TD-6, is announced by IHC. Principal engineering changes in these new models are increased horsepower ratings; a modern streamlined "new look"; better operator visibility; Cerametallic clutch facings; pressurized covering systems; 500-hour track roller seals; and all-weather, positive, easy-starting conversion systems. The Cerametallic clutch facing, on all models, is said to give more rapid and positive engagement with new heat-resisting, and power-holding

Crawler tractor comes in four models

characteristics. The TD-6 tractor is rated at 41.5 hp.; the TD-9 with a 54.5 drawbar hp and 66 belt hp.; the TD-14 has a drawbar hp of 78.5 and a belt hp of 89.5. The outstanding engineering features on the TD-18 are the new track roller seals, heavier radiator guards and IHC's gasoline-conversion, electric starting system which is provided as standard equipment. This TD-18 produces 124 hp at 1450 rpm, the drawbar pull is 24,300 pounds and the drawbar hp is 103. For details write International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 5-13** on the reply card.

A New Flush-Feeder That Aids Slurry Pumping

High concentration slurry solutions and corrosive liquids can now be effectively handled by an extremely simple flush-feeder developed by Proportioneers. Because of its ability to pump slurries of thin mud-like consistency, it is possible to use a fairly small make-up tank which can hold enough slurry for several days of operation, minimizing operator surveillance, and affording important operational economies. In the Flush-Feeder, the check valve assembly, mounted directly on the slurry tank, is separated from the metering pump so that slurry cannot enter the primary displacement cylinder. Since only water passes through the reagent ends of the feeder, the detrimental factors which make slurries and corrosive liquids hard to handle are eliminated. For details write Proportioneers, Inc., 345 Harris Avenue, Providence, Rhode Island, or circle **No. 5-14** on the reply card.



Check-valve difficulties minimized and corrosion eliminated in this flush-feeder

New Air Mask Developed

A new, versatile air mask that weighs only 35 pounds has been developed by Fyr-Fyter Co. The mask is designed for sewer work where gas and lack of oxygen are hazards; and for rescue, tunnels and fires. The mask is equipped with two cylinders, each holding 26 cubic feet of air; these are easily mounted on the wearer's back. Since none of the apparatus protrudes in front of the wearer, he has good maneuverability in narrow spaces and in climbing ladders. A Scotchlite "see in the dark" band on each cylinder makes them easily distinguishable in poor light or smoky atmospheres. For data write Fyr-Fyter Co., 221 Crane St., Dayton, Ohio, or circle **No. 5-15** on the reply card.

Pipe Locator-Leak Detector

This portable twelve-pound instrument, announced by Goldak, is designed to pin point the exact location of underground metallic structures including pipes, valves and risers. Attachments to the units, including a crystal microphone and probe, permit the user to locate leaks in liquid lines, high pressure gas lines and even pipes under vacuum. The unit consists of a transmitter and receiver and each contains its own flashlight cells and standard portable radio "B" batteries. Full details from the Goldak Co., Dept. 2., 1544 W. Glenoaks Blvd., Glendale 1, Calif., or circle **No. 5-16** on the reply card.

One man operates this new instrument

New Compact Sweeper For Congested Areas

A compact new 28-inch rider-type power sweeper for sweeping in congested areas has been developed by G. H. Tennant. It is specially designed for areas in factories, garages and warehouses where larger sweepers cannot be used. Traveling at speeds of 2 to 8 mph, it cleans a 28-inch path (40 inches with optional side brush) and can sweep up to 80,000 sq. ft. an hour. The main brush, revolving in a vacuum-equipped compartment, moves dirt and litter forward into a removable dirt hopper. At the same time, a high volume 11-inch fan draws dust and fine dirt from the brush compartment up into a fabric bag. For further information write G. H. Tennant Co., 2578 N. 2nd St., Minneapolis 11, Minn., or circle **No. 5-18** on the reply card.

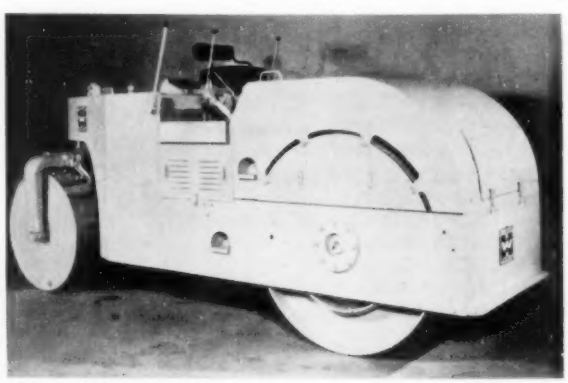
New Tandem Rollers With Torque Converter

A complete new line of medium and large size variable weight tandem rollers — with torque converters and two-speed transmissions as standard equipment is announced by Huber-Warco. All four models in the new line—the medium sized 5-8 and 8-10 rollers and the large 8-12 ton and 10-14 ton tandems—are identical in design. On all four machines the torque converter more than doubles the available power and supplies it instantly when needed. Other benefits of the unit include a decrease in fuel consumption; longer engine life; forward-reverse clutches and other machine components; and elimination of shock loads, stalling, over-loading, and the need for a master clutch. Through the use of a tail shaft governor, the roller will maintain closely any speed set by the operator, regardless of the grade encountered. The use of a two-speed transmission allows the engine to maintain sufficient RPMs to provide hydraulic pressure for fast steering at slow rolling speeds. Another valuable feature of these new rollers is a completely adjustable guide roll assembly to eliminate road "scuff."

Backhoe Equipped With Outriggers

The new Henry hydraulic backhoe Model C-10H now comes equipped with either hydraulic or manually controlled outriggers. The outriggers ease the problem of straight side ditching on sloping terrain. Without leaving his seat, the operator touches a valve and hydraulic action levels up the backhoe for straight side ditching on slopes up to a 25 percent grade. The sliding action of the telescopic boom permits the backhoe to dig 11 feet and load 8 feet. The boom swings in a 160 degree arc and will dig from any point within that radius. More information may be obtained from Henry Manufacturing Co., Inc., 1700 N. Clay St., Topeka, Kansas, or circle **No. 5-17** on the reply card.

Telescopic boom permits higher loading without power loss

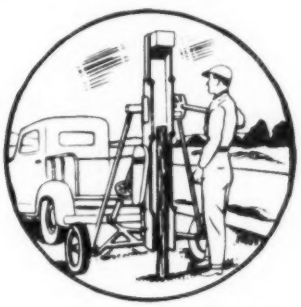


Variable weight tandem roller line comes in four models

Other features include: two completely independent braking systems; a variable speed hydraulic steering system: unusually close curb clearance: and a choice of gasoline or diesel power in all models. For details write Huber-Warco Company, Marion, Ohio or circle **No. 5-19** on the reply card.

Power Driving Reduces Cost of Placing Fence Posts

A high-speed post driver has been announced by Danuser Machine Co. The new implement is a lightweight, mobile pile driver, which can be

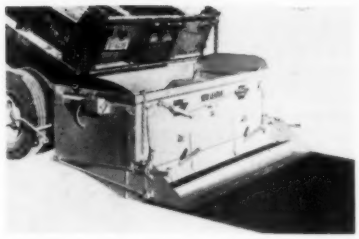


Post driver tilts to any angle

operated by gasoline engine or power take-off, and mounted on a trailer, jeep or tractor. The post driver will set steel or small wood posts in rocky or frozen ground, and easily drives posts up to 4 inches in diameter. It tilts to any angle for driving posts perpendicularly on uneven ground or hillsides. Highway maintenance departments and construction companies can use this machine in setting posts for highway guard rails, building snow fences or fencing industrial property. It can also be used for breaking concrete. For more details write Danuser Machine Co., Fulton, Mo., or circle **No. 5-20** on the reply card.

Bituminous Concrete and Aggregate Spreader

Highway Equipment Co. announces the new Model AS bituminous concrete and aggregate spreader. An important feature is an accurate scale on each end of the screed permitting the operator instantly to make the correct setting for the thickness of spread he desires. The wheelbase has been increased, permitting the floating screed to travel on a level plane spreading accurately at all times regardless of irregularities in the base. Optional equipment includes the improved hand operated hydraulic shut-off gate which stops the



New spreader can be used on small areas

flow of material and eliminates the necessity of emptying the spreader when changing course. Complete information from Highway Equipment Co., Inc., 616 D Ave., N. W., Cedar Rapids, Iowa, or circle **No. 5-21** on the reply card.

Control of Water Hammer

A new simplified flanged silent check valve for control of water hammer has been introduced by Williams Gauge Co. This unit is available in sizes from 1 to 10 inches, faced and drilled in accordance with A.S.A. standards for pressures from 125 to 2500 lbs. The valve can be furnished with special flange facings, including large male and female, ring joint, and large tongue and groove. For details write The Williams Gauge Co., Inc., 2 Gateway Center, Pittsburgh 22, Pa., or circle **No. 5-22** on the reply card.

A Municipal Loader Has 9 and 16-ft. Buckets

A hydraulic loader for construction and municipal uses has been introduced by The Farmhand Co. Designated the F-12, this loader mounts on most low-profile tractors now being used for loading and lifting. It has a 2000-lb. breakaway strength and 1000-lb. lift. Double-acting hydraulic cylinders are used for lifting and for controlling the bucket. The F-12 is available with both 9 and 16-cu. ft. materials buckets which can be attached in minutes. There is also a small dozer blade and dozer blade extension for moving dirt, sand or gravel. For full details write the Farmhand Co., Hopkins, Minn., or circle **No. 5-23** on the reply card.

Dodson's Digest

You can beat dust if you play your cards right

Drove out to see Jim Walker the other day. Jim is a county road commissioner, and when I got there he was busily thumbing through a stack of white cards.

"You're just in time, Dod," Jim said, fanning out the cards. "Take a card . . . any card."

"I don't get it," I said, taking one. "What's up?"

"What does it say?" Jim asked.

"It says 'Lincoln Road'," I replied. "But . . . "

"Then that's the name of the next street we're going to pave," Jim explained. "Everybody in town is complaining about the dust, so it doesn't matter much which one comes first."

"Wait a minute," I said. "What about dustproofing the unpaved roads with Calcium Chloride? That will keep down the dust. And it will keep your roads in better condition."

"Calcium Chloride is fine for those who can afford it," Jim agreed. "But I'd have to take the money out of my 20-mile paving program . . . It's costly, but . . . "

"Cut your paving to 18 miles," I interjected, "and you'll have enough money for 20 miles of Calcium Chloride treatment. That will give you 38 miles of smooth, dustless surface . . . and, what's more . . . "

"Now you're talking!" Jim said, enthused. "I'll be able to swing it without seriously cutting my paving program!"

"And what's more," I went on, "roads treated with Calcium Chloride provide a better base for future hard surfacing."

Jim reached for another stack of cards. "Let's decide where I'm going to buy my Calcium Chloride," he said. "Pick a card."

"It says 'Wyandotte Chemicals'," I grinned, quickly tearing it up. "I'm just lucky, I guess."

"You sure are," Jim laughed. "I could have sworn all those cards were blank."

— L. D. DODSON

P.S. — Our leaflet, "Wyandotte Calcium Chloride for Dustproofing," tells you how to lick the problem of bothersome dust. For your free copy, just drop me a line. *Wyandotte Chemicals Corporation, Wyandotte, Mich. Offices in principal cities.*

Wyandotte CHEMICALS

MICHIGAN ALKALI DIVISION

HEADQUARTERS FOR CALCIUM CHLORIDE

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

Bituminous Paving Research Scientist

Outstanding bituminous paving scientist to head up research program on well-known new paving material. Finest laboratory facilities (Atlantic seaboard). This opportunity is a challenging one with an international organization. Salary first year—approximately $15,000. Personal interviews will be arranged at our expense with selected applicants. BOX NO. 5-1.

CONSULTING ENGINEERING FIRM FOR SALE

Owner desires retirement and offers complete organization and practice for sale, including the following:

1. An established civil engineering and surveying practice of more than ten years.
2. A going concern of engineers, surveyors and draftsmen.
3. Air-conditioned offices and drafting room complete with furniture, supplies and equipment.
4. Surveying instruments, survey station wagons, including supplies and equipment.
5. Catalogue file.
6. All tracings, standard drawings and map files, including extensive coverage of area served.
7. All aerial photography, photogrammetry, etc.

Owner will sell complete organization as listed for the amount that the business earned in net profit last year. The firm is located in a large and growing southeastern city. The amount of work performed can be greatly expanded if new owner so desires.

Write Box No. 5-3.

For Information Regarding Rates In this Section

Write To:

Classified Ad Department
Care of this Magazine

CITY ENGINEER

Must have broad experience in all types of Municipal Engineering. Will have charge of Public Works construction and maintenance, including streets and airport; supervise inspection division, including building, electric, plumbing, and gas installations. Must be able to obtain registration in Colorado. Assistant Building Inspector also needed.

Write to:

W. D. TOYNE, CITY MANAGER
CITY OF GRAND JUNCTION
GRAND JUNCTION, COLORADO

POSITIONS AVAILABLE

SUPERINTENDENT $5500-$7000; CHEMIST $4500-$5500; MAINTENANCE SUPERVISOR (for mechanical and electrical equipment) $4500-$6000 and OPERATORS $3900-$4800 for new 18 MGD high-rate trickling filter sewage treatment plant to be placed in operation July 1, 1956. Positions available June 15, 1956. Vacation and sick leave benefits. Send resume of experience and minimum acceptable starting salary to:

CITY OF ALEXANDRIA
SANITATION AUTHORITY
113 NORTH ST. ASAPH ST.
ALEXANDRIA, VIRGINIA

OUTDOOR LIGHTING MAN WANTED

Man with experience in outdoor lighting field. To be trained as Assistant General Manager. Must have experience in engineering, estimating, buying, selling. Some traveling contacting agents and distributors necessary. Previous experience in outdoor lighting field desired. Recognized leading manufacturer in this industry.

Reply to:

Box 5-2

Care of this Magazine

Algae of Importance in Water Supply

This reprint, prepared in close collaboration with U. S. Public Health service authorities, includes for the first time in magazine history, full and accurate color plates for identification of types of algae most important in water supplies—those which cause tastes and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. The color plates are printed on one side of a page only, and are thus suitable for framing or mounting. The binding will permit the color plates to lie flat. Order your copy today.

$2.00 per copy

Send your check to:

Book Department, PUBLIC WORKS, 200 So. Broad St., Ridgewood, N. J.

Ferguson 8 to 12-Ton Tandem Roller

A new 8 to 12-ton variable weight tandem roller is announced by Shovel Supply Co. This roller is equipped with a rigidly constructed one-piece steel frame, heavy duty 6-cylinder gasoline or diesel engine, torque converter, two-speed transmission, instantly reversible clutches and 200-gallon water tank. The two-speed transmission, in conjunction with the Allison torque converter, gives an infinite variety of speeds from 0 to 5½ miles per hour. Compression roll is 60 inches in diameter and, when ballasted with water, gives a pressure of 287 pounds per inch of width. Further information from Shovel Supply Co., 4900 Hines Blvd., Dallas, Texas, or circle **No. 5-24** on the reply card.

Tandem roller has a variety of speeds

Fast Cutting Hammer Bits For Impact Drilling

A new tungsten carbide tipped hammer bit in sizes 3/16" thru 1½" has been developed by Tilden. These bits are of the solid chisel point type for sizes through ⅝", and core type with patented core slot for larger sizes having multiple carbide cutters. They operate successfully in self rotating air or electric hammers as well as standard hammers employing turning chucks. Removable extension shanks and extra length bits are available. For more data write Tilden Tool Mfg. Co., 209 Los Molinos, San Clemente, Calif., or circle **No. 5-25** on the coupon.

New Tractor Grouser Shoe Gives More Contact

A new track-type tractor grouser shoe, designed to give 15 percent more surface contact without increased width, has been announced by Shunk. Called the "Gripper Grouser Shoe", it obtains its extra surface area by means of a grouser shaped in the form of several continuous curves. Other advantages include increased flotation without traction loss, reduced sideslip and

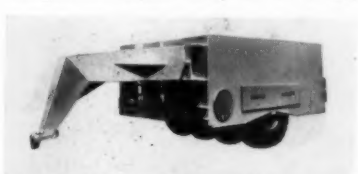
fishtailing and increased tractor rail. This shoe is available for replacement on most models of Allis-Chalmers, Caterpillar and International tractors. For. further information write Shunk Manufacturing Co., Bucyrus, Ohio, or circle **No. 5-26** on the reply card.

Hand Truck Climbs Stairs

A new stair climbing hand truck which safely doubles the load a man can roll up steps and trebles the load he can move down stairs or ramps has been announced by Valley Craft Products. It is equipped with a special ratchet mechanism which enables it to roll up stairs step by step as the operator pulls a cable drive. The two-wheel safety brakes prevent accidents when descending ramps or stairs with heavy loads. The truck is especially practical for handling such materials as chlorine cylinders, welding tanks, barrels, drums, castings, hardware and machinery. Six different models are available for handling various sizes of loads including a special barrel cart and a complete welding cart. For more information write Valley Craft Products, Inc., 750 Jefferson Ave., Lake City, Minn., or circle **No. 5-27** on the coupon.

Tamping Rollers and Pneumatic Compactors

A full line of roller-type compaction equipment is available from Chester Products Co. The "Little Giant" sheepsfoot type tamping rollers, Model 1760, are designed for lighter compaction work in subdivisions, on city streets and parkways, on county roads and highway shoulders or berms. The light weight of 6050 lbs., when emptied of water ballast, permits easy loading on flat bed trucks for quick moving from job to job. Total weight of the double-drum roller with water ballast is 10,487 lbs., giving 200 lbs. of pressure per square inch. The Model 4840, "Work Horse", is a double-drum roller equipped with wedge feet, with water and sand ballast, providing a total weight of 18,284 lbs., or 405 lbs. of pressure per square inch. The "Giant", Model 6060, is the heaviest with a total weight of 43,128 lbs., or 1450 lbs. per square inch. The Model 50T4 pneumatic compactor weighs 50 tons and is equipped with 4 wheels; each wheel is individually assembled to a ballast compartment exerting a maximum load per tire of 25,000 lbs. Total weight with ballast is 100,000 lbs., or 1250 lbs. of ground pressure per inch rolling width. More data from Chester Products Co., North Fifth St. and Ford Blvd., Hamilton, Ohio, or circle **No. 5-28** on the reply card.



Fifty ton pneumatic Chester compactor

Hands—Free Telephone Loudspeaker

Hands free telephoning is now possible with a new transistorized amplifier known as the Tel-O-Master made by Fisher. The telephone handset is simply placed on this new unit with the result that the incoming conversation is amplified to a normal conversational tone. Return conversation is automatically directed into the telephone handset by the Tel-O-Master. The principal advantage of the Tel-O-Master over conventional methods of phoning is that both hands are completely free to take notes, look up data, refer to rate or price schedules or files. It is also ideal for on-the-spot conferences since all present can easily listen to the incoming call and participate directly in the conversation. Completely portable, the Tel-O-Master requires no connections to the telephone or electrical system. Amplification is provided by four hermetically sealed transistors and power is provided by miniature mercury cell batteries. For additional information write Fisher Research Laboratory, Inc., Palo Alto, Calif., or circle **No. 5-29** on the reply card.

Telephone is placed on the amplifier

THE LATEST
VINYL PLASTIC WATERSTOP

for "wall-floor" and "between-pour" horizontal concrete construction joints

Water just can't get through joints protected by FLEXTRIP, the all-new, strip-type waterstop. Unique concave shape plus ribbed edges give FLEXTRIP a never ending grip in the concrete . . . is flexible enough to withstand extreme joint-separation (more than 3 inches) yet rigid enough to stand up to the battering effect of pouring concrete. Here's lasting joint-protection unmatched by any other waterstop. What's more, FLEXTRIP will never rust, rot, check or crack and is unaffected by acid, alkalies, petroleum products, chemicals or the most adverse atmospheric conditions . . . lasts as long as the concrete. Write for additional information on FLEXTRIP and other vinyl waterstops. Send coupon below.

Made by the makers of LABYRINTH WATERSTOPS . . . the standard waterseal on outstanding construction jobs everywhere — eliminates seepage problems . . . simplifies form work.

WATER SEALS, INC.
9 South Clinton • Dept. 6, Chicago 6, Ill.
Without obligation, please send me information on your new FLEXTRIP and LABYRINTH WATERSTOPS.

Name_____
Company_____
Address_____
City_____ Zone____ State____

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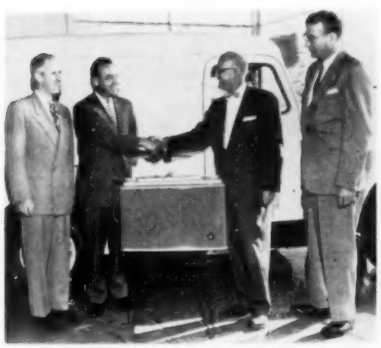
Mayor Hartsfield of Atlanta mans the wrench on Atlanta's 10,000th fire hydrant under the watchful eye of Paul Weir, head of the Atlanta water works. Above we show the "Oscar" replica of the same hydrant as presented to Mr. Weir by the Mueller Co., its maker.

—Worth Seeing



A cool summer is promised Virgil L. Larson (bow tie), winner of an IHC air conditioner at 1955 APWA show.

Thruway means bridges galore. Here the New York State Thruway passes over State Rt. 5 and New York Central Railroad near Herkimer. 100% welded deck cantilever plate girder structure has span of 775 ft. Lincoln Electric Co. photo.

Another voice from the sewer! Autographed portrait of Art Carney of Jackie Gleason's famed "Honeymooners" sketch was sent to W. E. (Eber) Robinson, president of Robinson Clay Product Co., Akron, on the company's 100th anniversary.

THE modern WAY
TO WIN THE
BATTLE OF THE ALGAE!

BERKITE NO. 13

Destroys algae in lakes, ponds, swimming pools...in minutes...

Berkite No. 13 is not only fast . . . it's amazingly thorough and safe. This *Modern* "wonder-drug" won't harm fish, birds, domestic animals or swimmers when used as directed. Destroys algae spores before they develop. Quickly kills even heavy algae growth in pools and lakes. One gallon Berkite No. 13 is usually sufficient for one million gallons of water. Treatment often need not be repeated for a month or more! The first anti-algae economical enough for use in large pools. Order it now.

Other algaecides developed by *Modern*, leading manufacturers of water treatment chemicals and pool supplies since 1935 . . . Algem, Alsan, Berkite No. 4. All easy to use, effective, harmless. Send for free Catalog giving complete data on chemicals and over 100 quality items plus valuable facts on pool care and maintenance. Ask for Catalog No. 13-S

For further information, see classified telephone directory for name of nearest distributor or write us.

modern GIVES YOU SO MUCH more...

modern
SWIMMING POOL CO., INC.
One Holland Avenue, White Plains, N.Y.

WORTH TELLING

by Arthur K. Akers

★ GENERAL ELECTRIC CO. has just made the first shipment of street lighting luminaires from its nearly-completed $8,000,000 Outdoor Lighting Department plant in Hendersonville, N. C. This department was transferred from Lynn, Mass.

★ W. L. WOLFE has been named sales manager of the new Speed King division of the Jaeger Machine Co., Columbus, Ohio.

★ HIGHWAY EQUIPMENT CO. INC. Cedar Rapids, Iowa, has promoted William Gaddis to vice-president and assistant general manager; succeeding his brother Roy Gaddis Jr., resigned to form his own company.

★ CHARLES H. SCHREYER has been elected president, Darling Valve and Manufacturing Co., Williamsport, Pa. Dick F. Sable of Dallas becomes general sales manager.

Mr. Sable

Mr. Rogers

★ M. E. ROGERS, project sales manager of Builders-Providence Inc., Omega Machine, and Proportioneers Inc. divisions of B-I-F, Providence, R. I., heads up a new service for consulting engineers, designers, and water and sewage works engineers. Six newly appointed district engineers under Mr. Rogers will now be available to aid in solution of problems involving meters, feeders, and controls.

★ A MAJOR expansion of the national sales structure of Motorola Communications and Electronics Inc., Chicago, is evidenced in the establishment of four geographical sales divisions and appointment of six vice-presidents.

★ LOUIS F. FRAZZA is shown here taking the oath as Director of the Water and Sewerage Industry and Utilities Division, U. S. Department

of Commerce, in Washington. Lou is on loan from the Johns-Manville Sales Corporation.

★ JOHN J. HALVORSEN has joined the Orangeburg Mfg. Co., Orangeburg, N. Y., and Newark, Calif., as manager of sales and development of the company's new plastic pipe division.

★ THE FRANK G. HOUGH CO., Libertyville, Ill., does it again: this time a 55,000 square foot extension to their plant, to meet increased demand for their "PAYLOADER" tractor shovels.

★"THE SUBMERSIBLE STORY" is the title of a new 18-minute color sound film of Byron Jackson Division. For a showing, address Roger Barron, P. O. Box 2017 Terminal Annex, Los Angeles 54.

★ WILLIS L. OGDEN, vice president of Lakeside Engineering Co., Chicago, passed away March 26 in Janesville, Wis., after several weeks of illness.

Mr. Dingman

★ MICHAEL DINGMAN, formerly sales representative for Pfaff & Kendall, of Newark, N. J., has been appointed sales manager for Micro Balancing, Inc., Garden City Park, New York. Mr. Dingman will handle sales and promotion of the company's Lumatrol line of photo-electric street light controls.

★ SIGN in a mid-west advertising agency: My Mind is *Made Up* . . . Don't confuse me with facts.

All-round Dirt-Moving Team

for low-cost operation

LARGE ENOUGH to get jobs done fast—
SMALL ENOUGH for profitable use on low-yardage jobs

HD-11 crawler—75 drawbar hp. Gets more work done faster and at lower cost with these on-the-job advantages: shock-absorbing, all-steel, box-A main frame; rugged final drives that ride on straddle-mounted roller bearings; 1,000-hour lubrication intervals for truck wheels, idlers and support rollers; ceramic-lined master clutch that requires fewer adjustments, provides extra long life; plus new operator convenience that includes a big foam rubber seat and 24-volt direct electric starting.

AC-106 scraper—6.1 yd struck, 7.5 yd heaped. Plenty of features for fast, low-cost dirt moving: curved, offset cutting edge and "center-boiling" loading action; wide, low bowl to keep center of gravity low; high-flotation tires and ample ground clearance; maximum stability for working on slopes or rough terrain; 81-in. apron opening and forward-forced ejection for quick, clean dumping; easy adjustments; simple sheave system.

• • •

See these and other important earth-moving advantages of Allis-Chalmers crawler tractor and scraper combinations at your Allis-Chalmers construction machinery dealer. He has complete facilities to serve you—factory-trained servicemen, factory-approved methods and complete stocks of True Original Parts.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

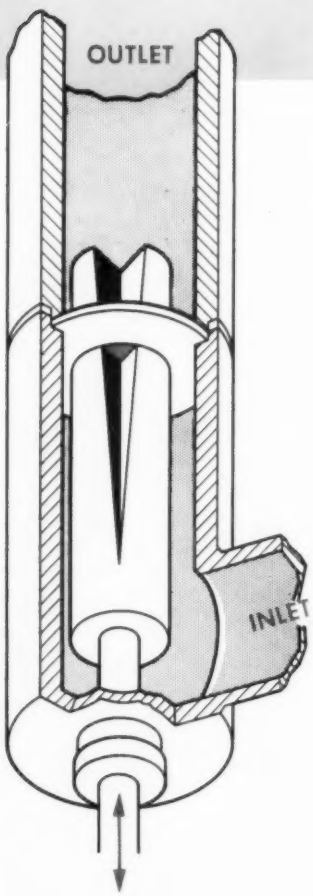
ALLIS-CHALMERS

THE WALLACE & TIERNAN

V-NOTCH

variable-orifice

. . . a new concept for chlorinator control



The W&T V-notch Variable-Orifice is the heart of a new chlorinator control system. With the system, a constant differential vacuum is maintained across the V-notch Variable-Orifice and the flow of chlorine gas is adjusted by varying the area of the orifice.

The W&T V-notch Variable-Orifice has these features:

- Wide range adjustment of chlorine flow
- Excellent reproducibility of flow by a simple adjustment
- Same % accuracy over entire wide flow range

As can be seen in the diagram, the V-notch Variable-Orifice is formed by a cylindrical plug positioned inside a matched, circular ring. A V-shaped groove is machined along the length of the plug. The groove starts near one end of the plug and gradually enlarges to its maximum width and depth at the other end of the plug. The V-notch Orifice is formed at the intersection of the grooved plug and the matched ring. The orifice area is varied simply and positively by positioning the plug backward or forward inside the fixed ring.

The V-notch Variable-Orifice is just one design feature of the new W&T V-notch line of chlorinators. Get all the facts about the W&T V-notch chlorinators before you buy chlorination equipment.

See W&T V-notch Chlorinators at the AWWA Convention, St. Louis, May 6-11.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

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